



# CHEMICAL ABSTRACTS

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## 1—APPARATUS

C. G. DERICK

**Researches in absolute piezometry. I. Comparison of the weight manometer with a glass deformation manometer.** ETTORE CARDOSO. *J. chim. phys.* 19, 217-43 (1921).—A weight manometer is described which consists essentially of a metal piston and cylinder closely fitted yet without friction. The unknown pressure is balanced by weights on the piston and is given by the expression  $P = F/\pi r^2$ , where  $r$  is the radius of the piston. It may be used up to 100 atm. with an accuracy of  $\pm 0.05$  atm. The glass deformation manometer is constructed like an ordinary Hg thermometer. The pressure is exerted on the outside of the Hg reservoir and the vol. change thus produced causes the Hg column inside the capillary to rise. This instrument is readily calibrated by comparison with the above weight manometer for pressures up to 100 atm. II. **Comparison of the weight manometer with the nitrogen manometer. Compressibility of nitrogen at 16°.** ETTORE CARDOSO AND TULLIO LEVI. *Ibid* 244-58.—Comparison is made between the weight manometer and the nitrogen manometer up to 100 atm. From these data values for the compressibility of  $N_2$  at 16° are calcd. which are in good agreement with the measurements of Amagat. J. A. ALMQUIST

**Engineers develop pocket viscometer.** ANON. *Nat. Petroleum News* 15, No. 30, 92-4 (1923).—A pocket viscometer consists of 2 bulbs, one carrying a standard liquid and the other the liquid to be tested. Viscosity in Saybolt sec. is read directly by the rate at which a sphere falls through each liquid. The accuracy of the instrument runs as high as 99% with an experienced operator. D. F. BROWN

**Simple reflux cooler.** H. HERRING. *Chem.-Ztg.* 47, 530 (1923).—A test-tube with a 2-hole stopper through which  $H_2O$  is delivered to the bottom of the tube and escapes is hung in the neck of the boiling flask. If the tube is nearly the size of the neck volatile solvents may be boiled without appreciable loss. J. H. MOORE

**The new precision pycnometer.** B. BERGDAHL. *Chem.-Ztg.* 47, 530 (1923).—The neck of the app. is cut off obliquely. The stopper has a hole bored from the lower end which passes through the side at a point just above the low side of the oblique neck. The stopper is inserted in the filled app., the excess liquid flows out through the hole in the stopper which is then turned to close the hole. J. H. MOORE

**A new vacuum pump.** C. C. CHEN. *Science* 58, 18 (1923); 1 cut.—This is a modified Sprengel pump, assembled complete in rigidly fixed position. As in the Sprengel, vacuum is produced by the flow of Hg through a tube of small aperture inside a bulb, which in turn is sealed to a McLeod gage and to the vessel to be exhausted. The Hg is returned to the main reservoir by way of falling and return tubes under suction from an ordinary water pump. Two bulbs between the main reservoir and aperture serve to divert the air, trapped by the Hg in its fall through the falling tube, to the water pump for removal. Suitable stopcocks at various positions make possible a regulation of flow of Hg as well as removal of air from the vessel to be evacuated. A vacuum of about 0.02 mm. is obtainable. The advantages are: elimination of raising or lowering of a heavy Hg reservoir, prevention of air bubbles from passing from the Hg reservoir to the falling tube, automatic operation, simplicity, and suitability for exhaustion as well as for collection of gases. THEO. F. BUEHRER

**The treatment of membrane filters.** GERHART JANDER. *Z. angew. Chem.* 35, 269 (1922); cf. *C. A.* 16, 220, 3043; 17, 904.—Directions and precautions are given for the treatment and preservation of membrane filters. A filter which has lost its smooth surface should be immersed in distd.  $H_2O$  at 75-80° for 0.5 hr. and then pressed tightly between glass plates. The filter and plates are immersed in  $H_2O$  at 75-80° for 1 hr. and the membrane then removed. Membrane filters must be kept damp by keeping immersed in distd.  $H_2O$  with a piece of Cu to keep the  $H_2O$  sterile. C. C. DAVIS

**New filtration apparatus.** VLAD SKOLA. *Z. Zuckerind. Cechoslovak. Rep.* 46,

423-30; *Chem. Zentr.* 1922, IV, 503.—An illustrated description of recent app. involving electroosmotic filtration and filtration *in vacuo*. C. C. DAVIS

**The Viscin air filter.** MELDAU. *Electrotechn. Z.* 44, 566(1923); 7 illus.—This filter comprises large metallic surfaces coated with viscinal. Details of construction are given. C. G. F.

**The filtration of viscous liquids.** A. GUTBIER AND E. SAUER. *Z. anorg. allgem. Chem.* 128, 15-16(1923).—A cellulose filtering medium, supported on porcelain, is described which has proven useful in the sepn. of fine solid suspensions. It may also be used for mucilaginous substances. J. A. ALMQUIST

**New method of cleaning vacuum filter leaves.** T. B. STEVENS. *J. Chem. Met. Soc. S. Africa* 23, 92-3(1922).—Economy in the cost of acid for removing lime incrustations from vacuum filter leaves may be effected by using  $H_2SO_4$  instead of  $HCl$ . The leaves, after brushing, are removed from the filter and soaked for 1 hr. in 2%  $H_2SO_4$  to convert the lime into  $CaSO_4$ , much of which becomes detached; they are then washed in gently running water for 2-3 days. The addn. of common salt to the wash water increases the soly. of the  $CaSO_4$ . J. S. C. I.

**New pulverizer.** J. SHINODA. *J. Pharm. Soc. Japan* No. 493, 156-9(1923).—The principle of this pulverizer is to tear a particle instead of pressing it. Two wire-basket-like truncated cones are placed one within the other; the space between them is greater at one end than at the other. A device to recharge the coarser powders is provided. It is intended to be used for pulverization of lighter and softer substances such as  $CaCO_3$ . Figures of the app. are given. S. T.

**Equipment that saves floor space.** G. L. MONTGOMERY. *Chem. Met. Eng.* 29, 96-7(1923).—In the paper abstracted in *C. A.* 17, 2754, a cooling conveyor designed for the bakery industry, is mentioned. M. gives illustrations of this conveyor, describes its construction and suggests its introduction to other industries, more specifically suggesting its use in annealing glassware, cooling various articles produced in the ceramic industries, for drying porcelain, tile, brick, refractories, etc., prior to burning, for annealing castings, drying leather, soap, etc. E. G. R. ARDAGH

**Compact stand holder.** A. SCHÖLLER. *Chem.-Ztg.* 47, 529-30(1923).—Inside a cast-Fe base are 2 fixed and 1 adjustable jaw, between which may be clamped Fe or glass rods, glass tubing, etc., to form stands of material at hand. J. H. MOORE

**New reversing mechanism for regenerative furnaces.** EMIL WURMBACH. *Feuerungstechnik* 11, 78-9(1923).—W. describes and illustrates 2 mechanisms for effecting reversal without the danger of losses from by-passing. ERNEST W. THIELE

**Dust removers for drier fans.** ANON. *Feuerungstechnik* 11, 91(1923).—This new system is for driers in which the air is mixed directly with hot flue gas. Enough air is mixed with the gas to cool it to a safe temp., and the dust removed in a large cyclone dust collector, followed by a filter. The rest of the air, which has been warmed by passing around the outside of the collector, is then added. ERNEST W. THIELE

**Recent special pumps and mills in the chemical industry.** B. WÄRNER. *Apparaturbau* 34, 177-80; *Chem. Zentr.* 1922, IV, 411.—A description of the acid turbine pump of the Amag-Hilpert-Pegnitz metallurgical works (Nürnberg), the acid centrifugal pump of the Hans Eicheler foundry (Wesseling, Köln) and the colloid mill of Plauson (Emil Passburg, Berlin). C. C. DAVIS

**Method for condensation without a special air pump with simultaneous removal of air from the cooling water.** EMIL HAHN. *Chem. App.* 10, 95-6(1923); cf. *C. A.* 17, 1299.—A description, with 3 cuts, of a method in which the cooling  $H_2O$  is forced through injectors in a compartment connected with barometric or surface condensers in such a way that air collected in the condensers is removed through the injectors and discharged into the open. In operating in connection with steam engines or turbines the saving amts. to 67-78% of the power required in the usual way. J. H. MOORE

**An actinometer with electrodes of mercury halides or sulfides.** G. ATHANASIU. *Compt. rend.* 175, 214-7(1922).—Expts. show that an actinometer may be made with Hg electrodes covered with a very thin layer of a compd. such as  $Hg_2I_2$ ,  $Hg_2Br_2$ ,  $Hg_2F_2$  and  $HgS$ , and in electrolyte. The light reaches the electrode from a vertical position after traversing 2-3 cm. of the electrolyte. The e.m.f. is measured with a potentiometer by a substitution method. The tabulated results show that light increases the potential of Hg covered with  $Hg_2F_2$ ,  $Hg_2Cl_2$ ,  $Hg_2Br_2$  and  $Hg_2I_2$  in the order given and in the case of  $HgS$  the potential is negative. The vols. given also vary with the kind of electrolyte. The reversible change is shown to be  $Hg_2Cl_2 \rightleftharpoons HgCl_2 + Hg$ . D. T. EWING

**Fusible plug investigation.** F. A. JOHNSTON. *Compressed Gas Manuf. Assoc. Bull. Tech. Series* 1923, 244-251.—A device was set up at the Staten Island plant of the S. S. White Dental Mfg. Co. for testing the behavior of the principal types of fusible

safety devices in use on cylinders of compressed gas subjected to the heat of gas flame. A 18" pipe 8' long was buried in the ground with a trench on either end for loading in the cylinder. Inside was a bracket for holding the test cylinder over a gas flame controlled by the operator from a barricade 20 ft. away. Temp. and pressure readings were taken with suitable devices. The results of several tests are plotted.

HOWARD E. BATSFORD

**Electrical water-level recorder.** ANON. *Arch. Wärmewirtschaft* 4, 23-4(1923).—The device is for steam boilers. A mass of iron in a non-magnetic tube rises and falls with a float. A balanced electromagnet, carrying a pen, surrounds the tube and is drawn up and down by the iron armature. Thus no stuffing-box is required.

ERNEST W. THIELE

**New induction coil for conductance measurements with alternating current operation.** FERD. SCHEMINSKY. *Z. physik. Chem.* 104, 349-53(1923).—See C. A. 17, 2374.

H. JERMAIN CREIGHTON

**A constant-temperature oven.** C. M. MACKALL, G. E. MILLER AND E. E. REID. *Ind. Eng. Chem.* 15, 121(1923).

H. G.

The constant-volume gas thermometer (KHYBS) 2.

**Apparatus for aerating liquids.** C. J. C. W. HYNÉ. *Brit.* 190,186, June 20, 1921.

**Apparatus for absorbing and recovering gases.** FARWERKE VORM. MEISTER, LUCIUS & BRÜNING. *Brit.* 191,005, Nov. 16, 1922. Addn. to 187,223 (C. A. 17, 905). The app. described in the principal patent for absorbing gases in charcoal, recovering the absorbed product, and prep. the charcoal for re-use in a continuous manner is modified by so constructing the partitions that the system forms a series of single vessels arranged in a ring.

**Condenser for steam or other gases or vapors.** C. R. and M. C. MABEE. U. S. 1,461,364, July 10.

**Centrifugal air cleaner.** C. R. SHORT and A. L. CASE. U. S. 1,461,630, July 10.  
**Device for separating moisture, oil, etc., from air.** J. A. PAASCHÉ. U. S. 1,461,045, July 10.

**Oil filter.** R. S. MOORE and L. B. JONES. U. S. 1,461,627, July 10.

**Hollow cylindrical pressure filter.** F. W. MANNING. U. S. 1,459,836, June 26. A sludge inlet is provided in one end of a cylindrical filter, with a conveyor for removing solids filtered from the sludge. Filtrate is discharged from the other end of the shell.

**Acetylene: welding plant.** T. KAUTNY. *Brit.* 191,057, Dec. 27, 1922. The supply of carbide to the  $C_2H_2$  generator of an oxyacetylene welding plant is controlled by the pressure of the O supply in such a manner that carbide is fed whenever the pressure in the generator falls below the O pressure. A suitable construction is specified.

**Fire extinguisher.** ZENKICHI MIYAZAKI and DENKICHI KURASHIMA. Japan. 41,616. Jan. 31, 1922. A cylindrical vessel contg. liquid  $CO_2$  is inserted in a main cylindrical vessel contg.  $H_2O$ . By slight turning of the first vessel,  $CO_2$  flows from the bottom into the  $H_2O$ , cooling it and forcing it out of the container.

**Vacuum electron tube.** SHUNKICHI KIMURA AND THE NIPPON MUSEN DENSHIN DENWA KABUSHIKI KAISHA. Japan. 41,608. Jan. 31, 1922. The positive pole (plate) and the auxiliary positive plate (grid) in an electron tube consist of a hollow tube and a spiral, into which a suitable cooling fluid (liquid or gas) is passed. By this means the efficiency, safety and life of the tube are increased.

**Specific gravity indicator (float).** R. P. SEARLE. U. S. 1,459,752, June 26. A float for testing the sp. gr. of lubricating oil in engine crank cases or other liquids to be kept at a desired standard is made in elongated form with one end weighted so that it will float if the liquid has a sp. gr. up to the desired standard but will tend to sink at a lower sp. gr. and give the device various angular positions.

**Ozone generator.** H. B. HARTMAN. Can. 232,412, July 3, 1923.

**Ozone generator.** H. B. HARTMAN. Can. 232,413, July 3, 1923.

## 2—GENERAL AND PHYSICAL CHEMISTRY

GEORGE L. CLARK

Ernst Beckmann on his seventieth birthday, July 4, 1923. G. L. *Z. anorg. Chem.* 36, 341-4(1923); portrait. Ernst Beckmann's beginning as a physical chemist. WILHELM OSTWALD. *Ibid.* 344. The research institute. ALFRED STOCK. *Ibid.* 344-5.—



Homage is paid by the present director of the Kaiser-Wilhelm-Institut für Chemie to Beckmann, a former director. E. J. C.

William Gowland. W. A. T. *Proc. Roy. Soc. (London)* **94B**, xl-xliii(1923).—Obituary, with portrait and an account of G.'s contributions to chemistry and metallurgy. JOSEPH S. HEPBURN

The life and accomplishments of Philippe Auguste Guye (1862-1922). ANON. *Bull. soc. chim.* **33**, 661-72(1923). E. J. C.

Parker Cairns McIlhenny. A. H. SABIN. *Ind. Eng. Chem.* **15**, 870(1923).—An obituary, with portrait. E. J. C.

Alfred Springer. EDWARD HART. *Ind. Eng. Chem.* **15**, 864(1923).—A brief biography, with portrait. E. J. C.

Recent advances in science—Crystallography. A. SCOTT. *Science Progress* **17**, 556-61(1923).—Review of recent work on the crystallography of various chem. elements and compds. JOSEPH S. HEPBURN

Recent advances in science—Physics. J. RICE. *Science Progress* **17**, 536-40. —Review of recent work on the mol. diffraction of light. JOSEPH S. HEPBURN

Recent advances in science—Physical chemistry. W. E. GARNER. *Science Progress* **17**, 540-5(1923).—Review of recent work on new elements, the photochemistry of mixts. of  $\text{Cl}_2$  and  $\text{H}_2$ , the physical chemistry of foodstuffs, and the adsorption and fluorescent spectra of aromatic hydrocarbons. JOSEPH S. HEPBURN

Applied and pure science. ENOCH KARRER. *Science* **58**, 19-23(1923).—Definitions and discussion. E. J. C.

The Bureau of Chemistry of the U. S. Department of Agriculture. R. S. McBRIDE. *Chem. Met. Eng.* **29**, 137-41(1923).—Descriptive of its organization and work. E. J. C.

The history of alchemy, with special reference to Egypt. A. J. HOPKINS. *Cairo Sci. J.* **11**, 159-69(1923). E. J. C.

Matter and energy. W. J. POPE. *Chemistry & Industry* **42**, 52-4, 72-4(1923).—Paper delivered before the Greenoch Philosophical Society on January 12, 1923, in honor of James Watt, who first detd. the compn. of water. P. D. V. MANNING

The law of definite proportions in the light of modern research. U. R. EVANS. *Trans. Faraday Soc.* (advance proof) 1923.—Many of the series of solid solns. met with in alloys show a max. m. p. (i. e., a max. thermal stability) at a compn. indicated by a simple at. formula (e. g.,  $\text{AuMg}$ ); it is customary to describe this member of the series as an "intermetallic compound," and to regard it as the parent of the series. But in cases where there is a max. hardness (i. e. max. mech. stability) at a compn. indicated by a simple at. formula (e. g.  $\text{AgAu}$ ), or where there is an abrupt change of chem. behavior (a parting-limit), it is not at present customary to apply the word "compound." Clearly the use of the word "compound" is one of convenience; there is no definite distinction between a compd. and a mixed crystal. The compd. is in many cases merely a member of a continuous series of solid solns. possessing greater stability and therefore greater importance than other members; the fact that the max. stability usually occurs at a compn. expressible by a simple formula is often capable of a phys. explanation. Many of the oxides of those metals which possess more than one valence have a variable compn.; the decompn. pressure varies gradually with the O content, thus distinguishing these solid solns. from mech. mixts. There is a continuous series (or, according to some chemists, a broken series) of Fe-O crystals varying in compn. between  $\text{Fe}_3\text{O}_4$  and  $\text{Fe}_2\text{O}_3$ ; pure  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$  may be regarded as the end-members of the series. Likewise homogeneous substances of variable-O content occur among the oxides of Pt, Ir, Ni, Mo, W and possibly Ag, Pb, and Tl. Among the chlorides there is a series of homogeneous substances with  $\text{TiCl}_3$ ,  $3\text{TiCl}_2$  and  $\text{TiCl}_4$  as end-members, while crystals of variable compn. exist in subchlorides and subbromides of Bi; among the sulfides there is a series ranging from  $\text{Cu}_2\text{S}$  to  $\text{CuS}$ ; pyrrhotite is another case of a sulfide of variable compn., while mixed crystals also exist in the sulfides of Ni and Co. The cause of the max. hardness of metallic mixed crystals at equi-at. compn. is discussed in an appendix. JAMES M. BELL

The unification of the laws of chemical combination. E. PUXEDDU. *Gazz. chim. ital.* **53**, 204-9(1923).—In a previous paper (*C. A.* **14**, 481) P. showed (1) that the law of multiple proportions has a significance that is not revealed by the manner in which it is commonly expressed; (2) that the new way of stating the law proposed by Balarew (*J. prakt. Chem.* **95**, 397(1917)) does not correspond to the spirit of the old Daltonian principle; (3) that the law of the atoms of Cannizzaro ought to serve as a basis for the study of all the principles of chem. combinations. Owing to an inveterate tradition, and habits of writing, the law of const. proportions, the law of multiple proportions,

the law of equivalents, the law of Gay-Lussac, etc., are dealt with as a series of principles rather than as various aspects of a single principle: the fundamental law of chemical combination. After reviewing the recent restatements of the law of multiple proportions briefly P. finds them defective. The following statement of the law of equivalence expresses the true concept: "the quantity by wt. of various elements that combines with the same quantity of one of them, taken as a basis of comparison, represents also the quantity according to which, or according to multiples or submultiples of which, the same elements combine with each other." In other words there is a certain weighable unit according to which an element accomplishes all its chemical combinations. P.'s statement of Gay-Lussac's law follows: "The elements in the gaseous state combine according to volumetric ratios corresponding to the atomic ratios." Cannizzaro's law of atoms is stated thus: "The various quantities of a given element that are contained in the various mols. of its compounds are all whole multiples of an identical quantity which since it always enters completely is properly called an atom." In concluding P. states that no doubt exists as to the real existence of atoms but that there is no corresponding evidence for the real existence of equivalents. The laws of chemical combination may be treated by the atomistic method by assuming the law of Cannizzaro as the fundamental principle.

**Valency and radiation.** F. H. LORING. *Chem. News* 126, 273-4 (1923).—A statement of the conflict between the octet theory of valence and the Bohr theory.

**The electronic theory of valence. I. Intramolecular ionization.** T. M. LOWRY. *Phil. Mag.* [6] 45, 1105-18 (1923).—Intramolecular ionization (based on the experimental evidence of J. J. Thomson (*C. A.* 8, 2510) that positive rays are converted to negative ions by taking up electrons after passing through the cathode) is postulated in a number of compounds where the charges on the nucleus are not balanced by the enveloping electrons. Accordingly  $\text{H}_2\text{O}_2$  may be regarded as  $\text{O}-\overset{+}{\text{O}}-\overset{-}{\text{O}}$ ;  $\text{O}_3$  as  $\text{O}-\overset{+}{\text{O}} = \text{O}$ , etc. The stability

of the oxy-acids depends on the presence of positive charge on the central atom of the

ion; thus the anions  $\text{SO}_4$  and  $\text{PO}_4$  would be:  $\text{O}=\overset{+}{\text{S}}(\text{O})_3^-$  and  $\text{O}=\overset{+}{\text{P}}(\text{O})_3^-$ . The progressive stability of the acids with increase of this central positive charge is illustrated

by the chloro acids in passing from  $\text{Cl}$  in  $\text{HCl}$  through  $\text{Cl}$  in  $\text{HClO}$  to  $\overset{+}{\text{Cl}}$ ,  $\overset{++}{\text{Cl}}$  and  $\overset{+++}{\text{Cl}}$  in  $\text{HClO}_2$ ,  $\text{HClO}_3$ , and  $\text{HClO}_4$ , resp. A maximum of stability and strength is reached in acids containing 4 O atoms around the central atom of the anion, as illustrated by  $\text{HClO}_4$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$ , etc. The old theory of successive dehydration of full hydrates such as  $\text{P}(\text{OH})_5$ , may be rejected. For the dehydrated acids the sextet configuration of Lewis (*C. A.* 10, 1121) for the central atom is adopted to advantage. The acidifying properties

of O receive an explanation through the increasing repulsion of  $\overset{+}{\text{H}}$  from the positively charged central atom, made positive by being robbed of electrons by the O atoms of the anion radical.

**The valency of boron.** J. BÖESEKEN. *Proc. Acad. Sci. Amsterdam* 26, 97-111 (1923).—The Lewis-Langmuir octet theory is discussed and the structure of several complex organic boric acid compounds considered. In general, B is trivalent with 1 polar and 4 non-polar bonds, the latter arranged in a tetrahedron as in C. E. D. W.

**Calculation of atomic weights.** KARL FEHRLE. *Z. Physik* 13, 264-7 (1923); cf. *C. A.* 14, 3174; 15, 195, 781.

**Revision of the atomic weight of iron.** Analysis of ferric chloride. O. HÖNIGSCHMID, L. BIRCKENBACH AND R. ZEISS. *Ber.* 56B, 1473-81 (1923).—In the modern determinations of the atomic weight of iron two reactions have been used: the reduction of  $\text{Fe}_2\text{O}_3$  and the analysis of  $\text{FeBr}_3$ . An attempt here made to prepare  $\text{FeBr}_3$  for atomic weight analysis failed because of dissociation at the sublimation temperature. The stable  $\text{FeCl}_3$  was prepared by the action of Cl on iron powder and was sublimed in dry air. The weighed sample was then dissolved in a dilute solution of  $\text{HNO}_3$  at  $0^\circ$  to avoid the formation of colloidal  $\text{Fe}(\text{OH})_3$ . The Cl was precipitated with Ag by the usual nephelometric method. From the ratio  $\text{Fe}:\text{Cl}:\text{Ag}$  the mean value of the atomic weight of iron is 55.852 from 11 determinations with an average variation of  $\pm 0.003$ . From the ratio  $\text{FeCl}_3:3\text{AgCl}$  the value is  $55.854 \pm 0.005$ . From the general average 55.85 is proposed, a value in excellent accord with the results of Richards and Baxter, whose results in 5 series of determinations range from 55.833 to 55.835. J. M. B.

**New method of determination of the atomic weight of tellurium.** P. BRUYLANTS AND J. MICHELSEN. *Bull. sci. acad. roy. Belg.* [v] 5, 119-130(1919); cf. C. A. 16, 2430.—The ratios Te:H<sub>2</sub> and Te:H<sub>2</sub>O have been measured. H telluride, prepd. by the electrolysis of dil. H<sub>2</sub>SO<sub>4</sub> with a Te cathode, was purified by fractional distn., etc., from the accompanying hydrides of S, Se, and Sb, and decomposed into its elements at a temp. of 200-20°. The Te was weighed as such, and the H oxidized to water by means of CuO. A marked difference obtained between the ratio Te:H<sub>2</sub> measured directly, and that measured indirectly through water, was traced to incomplete decompn. of the H telluride, and, correcting for this, the authors obtain the figure 127.8 for the at. wt. of Te.

J. C. S.

**The space lattice of the lithium halides.** HEINRICH OTT. *Physik. Z.* 24, 209-12 (1923).—By introducing the water-free salts into a cylinder of paraffined paper and filling with paraffin, X-ray spectrographs of the anhyd. materials could be obtained. The effect of the cylinder was obtained from known substances as NaCl, AgBr, etc. The chloride, bromide and iodide were studied and all were found to belong to the NaCl type. No indication of a second modification of anhyd. LiCl, as described by Lehmann, was discovered.

A. E. STEARN

**The structure of the sulfides of magnesium, calcium, strontium and barium.** SVEN HOLGERSSON. *Z. anorg. allgem. Chem.* 126, 179-82(1923).—X-ray powd. photographs show that the structure of these sulfides is of the NaCl type. Following are the lengths of the sides of the elementary cubes, in Angstrom units: MgS, 5.078 ± 0.012; CaS, 5.600 ± 0.008; SrS, 5.866 ± 0.011; BaS, 5.346 ± 0.003.

R. H. LOMBARD

**Active hydrogen by the action of an acid on a metal.** A. C. GRUBB. *Nature* 111, 600(1923); *Science* 57, 696-7.—If HCl or H<sub>2</sub>SO<sub>4</sub> is allowed to drop on metallic Mg suspended in such a way that the metal is at no time immersed in liquid, H is evolved almost explosively. If this H is brought in contact with pure N, NH<sub>3</sub> is formed. The activity of the H persists after passing through glass wool, showing that it is not due to ions or at. gas. Moreover at. H does not react with N to form NH<sub>3</sub>. The life of the active gas is not longer than 2 min., which checks closely with the life of H<sub>2</sub> formed by other methods. The results seem to substantiate the theory that H<sub>2</sub> ought to be produced wherever at. H is evolved. (Cf. Wendt and Landauer, C. A. 16, 1343.)

HARRY B. WEISER

**Single crystals of aluminium and other metals.** C. J. SMITHHELLS. *Nature* 111, 601(1923).—The fracture of W wire consisting of a single crystal is of the wedge type, the wire being very greatly reduced in diam. in one plane while it suffers no appreciable reduction in the plane at right angles. Two photomicrographs are given.

HARRY B. WEISER

**The theoretical isotherm of J. Thomson and the new equation of state for gases.** A. LÉDUC. *Compt. rend.* 176, 1456-8(1923).—Corresponding to the proposed equation of state (C. A. 17, 2377) the value of  $\int_{v_1}^{v_2} p dv$ , where  $v_1$  and  $v_2$  are the sp. volumes of boil-

ing liquid and of satd. vapor of CO<sub>2</sub> at 20° from Amagat's data, accords within 1% of the value of  $F(v_2 - v_1)$ , where  $F$  is the pressure of the satd. vapor at 20°. This accord is as good as the data warrant and is much closer than is given by either of the formulas of Clausius or of van der Waals.

JAMES M. BELL

**The pressures of gaseous mixtures.** IRVINE MASSON AND L. G. P. DOLLEY. *Proc. Roy. Soc. (London)* 103A, 524-38(1923).—Dalton's law may be expressed precisely either as the law of additive pressures (as originally stated by Dalton) or as the law of additive vols. The accuracy of these two statements has been investigated by measuring the pressures and vols. at 24.95° up to 125 atm. of the following mixts.: A, C<sub>2</sub>H<sub>4</sub>; O<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>; and A, O<sub>2</sub>. It is found that the law of additive pressures is the more accurate statement, but neither is precise. The max. deviation from additive vols. was about 30% (for A, C<sub>2</sub>H<sub>4</sub>) and from additive pressures was about 8% for positive deviations and 9% for negative deviations (both for A, C<sub>2</sub>H<sub>4</sub>). Tables of the deviations are given, and it is pointed out that these are the results of purely phys. action. There is no evidence, e. g., of any greater attraction between O<sub>2</sub> and C<sub>2</sub>H<sub>4</sub> mols. than between A and C<sub>2</sub>H<sub>4</sub> mols. at the temps. and pressures studied.

A. W. KENNEY

**Vapor pressures of sulfur dioxide.** W. MUND. *Bull. sci. acad. roy. Belg.* [v], 5, 529-43(1919).—M. has detd., by the static method, the vapor pressures of SO<sub>2</sub> corresponding with temps. between -42° and 0°. The errors common to such detns. are examd. and eliminated by methods for the description of which the original paper should be consulted. The vapor pressure of SO<sub>2</sub> at 0° was found to be 1163.98 mm. or 1.53 atm., other detns. being made at the temp. of fusion of certain eutectic mixts. (cf. Bruylants and Mund, *Ibid* 113.)

J. C. S.

**The vapor pressure of lead.** I. A. C. EGERTON. *Proc. Roy. Soc. (London)* 103A, 469-86(1923).—The vapor pressure of carefully purified Pb was detd. by weighing the amt. diffusing through a hole of known area in a high vacuum. The temp. was kept const. to within  $1/4^\circ$  at  $800^\circ$  by a sensitive relay actuated by light acting on a Se cell. Pressures were measured down to  $10^{-4}$  mm. The vapor pressure of ordinary molten Pb at  $600-1200^\circ$  is  $\log p = 7.908 - 9923/T$ , where  $p$  is in mm. The heat of vaporization (calcd. from the vapor pressure) is practically const. up to  $1200^\circ$  abs. at 45,350 cal. The heat of vaporization of solid Pb at  $0^\circ$  abs. is 47,000  $\pm$  1000 cal. The chem. const. of ordinary Pb is  $1.8 \pm 0.2$ , which agrees with the theoretical value  $1.853 = 1/2 \log M - C_6$ . Uranium Pb has a vapor pressure at  $700^\circ$ , 2% higher than ordinary Pb, but this result is not conclusive inasmuch as Pb suffers a lowering of vapor pressure when heated for a long time *in vacuo*; hence the data are not entirely reproducible.

**Evaporation.** J. SHINODA. *J. Pharm. Soc. Japan* No. 495, 324-30(1923)—S. measures the rate of evapn. of  $H_2O$  and lactic acid soln. using a steam bath and direct heat with variations in speeds of stirring, and intensity and direction of the air current. On the steam bath, and with the fan used at such a speed as to be just strong enough to remove the steam, the rate of evapn. increases by 24%, and with a strong current it decreases by 24%. Stirring is more effective than a fan, especially for evapn. of a soln. with higher sp. gr. With a direct flame, the use of a fan is detrimental (14-35% decrease), while stirring increases the rate slightly (6-1%). A gentle stirring is more beneficial than a more vigorous one, which probably lowers the temp. S. T.

**The ratio of the densities of liquid and vapor.** WOJCIECH SWIENTOSLAWSKI. *Bull. soc. chim. [iv]* 29, 499-507(1921).—On the basis of the phys. consts. of a no. of compds. as detd. by different workers, it is shown that the ratio  $k$  of the density of the liquid  $d_l$  to that of the vapor  $d_v$  is a function of the relative temp.  $\tau = T/T_c$  and as a first approximation does not depend on the individual properties of the liquid. Certain physico-chem. properties of liquids are considered in the light of this. J. C. S.

**Influence of experimental conditions on the determination of the level of liquids by means of level-indicating points.** H. GAULT AND F. VLÈS. *Mai. grasses* 15, 6471-3(1923).—Vertical points allow of easier and more accurate readings than horizontal ones. Points extending upwards give accurate readings whether the surface of the liquid rises or falls; those extending downwards are extremely sensitive for rising liquids. The latter consistently give results about 0.1 mm. lower than the former in water. The differences depend on the nature of the liquid being measured. For very accurate measurements the direction of the points exerts an appreciable influence; but not for ordinary measurements if the readings are taken with reasonable care. It may, however, influence results when readings are taken rapidly, especially in the case of Engler viscometers. The direction of the incident light may have some influence in certain cases.

**Colloidon membrane for liquid junctions.** H. FALES AND M. J. STAMMELMAN. *J. Am. Chem. Soc.* 45, 1271-2(1923).—The word "colloidal" in the abstract in C. A. 17, 2214 should read "colloidon." E. J. C.

**Change of properties of substances on drying.** II. H. B. BAKER. *J. Chem. Soc.* 123, 1223-4(1923); cf. C. A. 16, 2441.—A definite fractional distn. of dried benzene has been effected, the highest temp. of the vapor observed being  $87^\circ$ . The m. ps. of  $SO_2$  (dried for 20 years), Br (dried for 10 years), and benzene (dried for 10 years), have been found to be  $61^\circ$ ,  $-4.5^\circ$ , and  $6^\circ$ , resp. The vapor density of ether (dried for 10 years) has been found to be 81.7, more than double the normal, and of MeOH, dried for the same length of time, to be 45, compared with the normal 15. JAMES M. BELL.

**Density and the refractive index of mixtures of acetaldehyde and water or ethyl alcohol.** E. VAN AUVEL. *Bull. sci. acad. roy. Belg.* 1921, 180-2.—Mainly a question of priority. Attention is also directed to some values for the coeff. of thermal expansion of certain mixts. of AcH and  $H_2O$ . J. C. S.

**New method for studying the surface and the surface change of finely divided substances.** OTTO HAHN AND O. MÜLLER. *Z. Elektrochem.* 29, 189-92(1923).—In many chem. contact processes the surface formation of the active substance plays a decisive role. The new method for studying the surface of finely divided substances is a modification of that developed by Parretti and Vorwerk (cf. C. A. 16, 3784), and consists in mixing the substance, prior to pptn., with a small quantity of a radioactive material (e. g., RaTh, Ra, etc.), and subsequently measuring the amt. of emanation given off by the mixt. The emanating capacity increases with the surface of the finely divided substance. The method depends on the adsorption of the radioactive material by the finely divided substance. H. JERMAIN CREIGHTON

**Phase boundary forces.** R. BRUTNER. *Z. physik. Chem.* **104**, 472-4 (1923).—  
 Polemical against E. Baur (cf. *C. A.* **17**, 920). H. JERMAIN CREIGHTON

**The use of the centrifuge in coagulation of electrolytes.** E. F. BURTON and J. E. CURRIE. *Trans. Roy. Soc. Canada* **16**, III, 109-12 (1922).—To a series of 50-cc. portions of an  $As_2S_3$  hydrosol contg. 0.2342 g. per 100 cc. increasing amts. of an  $Al_2(SO_4)_3$  soln. were added. Each portion was then divided in half, one part let stand for some weeks and the other centrifuged for 20 min. at 2750 r. p. m. Complete coagulation occurred at the same concn. of  $Al_2(SO_4)_3$  after 20 min. in the centrifuge as on prolonged action of gravity alone. The density of colloidal  $As_2S_3$  was found to be 3.45, by the pycnometer method, the same as that of  $As_2S_3$  in mass. "This seems to be quite conclusive evidence that the ultimate structure of the particles is not of a loosely packed, spongy nature, but is as compact as the sulfide in large masses." F. L. BROWNE

**Electric charge of colloids.** H. R. KRUYT. *Nature* **111**, 827 (1923).—The elec. double layer of lyophilic and of lyophobic colloids is electro-capillary in origin and not necessarily due to the adsorption of ions of the solute. In the case of a negative sol of AgBr, with KBr in excess, the double layer consists of adsorbed  $Br^-$  ions and the associated  $K^+$  ions. The only difference between emulsoids and suspensoids is that the former are hydrated to a large extent. *Tanning* is mere dehydration. F. E. B.

**An aluminum gel of the formula  $Al(OH)_3$ . II. Hydrate and hydrogel.** RICHARD WILLSTÄTTER and HEINRICH KRAUT. *Ber.* **56B**, 1117-21 (1923).—When  $Al$  hydroxide is prepd. by a careful mixing of a concd. soln. of  $Al_2(SO_4)_3$  and a very slight excess of  $NH_4OH$  a voluminous flocculent ppt. forms. When this is dried *in vacuo* over  $P_2O_5$  its formula is  $Al(OH)_3$ . It is sol. in 1% HCl, and stable up to  $180^\circ$ . It is not a cryst. hydrate of  $Al_2O_3$  but a definite compd. It is a good adsorbent. When a larger excess of  $NH_4OH$  is used, the ppt. contains less water and is less basic in the sense that a more concd. soln. of HCl is required to dissolve it. Ordinary ppts. of  $Al$  hydroxide are mixts. of  $Al(OH)_3$  and partially dehydrated  $Al(OH)_3$ . The higher the water content the more basic the ppt. F. E. BROWN

**Electro-viscous effect in rubber sol.** H. R. KRUYT and W. A. N. EGGINK. *Proc. Acad. Sci. Amsterdam* **26**, 43-8 (1923).—The sols used were prepd. by leaving benzene in contact with crepe-rubber for 24 hrs. The following electrolytes were dissolved in benzene and the viscosities of mixts. measured: HCl,  $SO_2$ ,  $H_2S$ ,  $CH_3COOH$ ,  $CaH_2COOH$ ,  $HgCl$  and  $NH_3$ . The max. lowering effect takes place with HCl at a concn. of 0.001 mol. per l., the viscosity being decreased 15%. The effects of the other substances are less and are in the order in which they are named, the initial effect on the viscosity in the case of  $NH_3$  being an increase of about 3% at a concn. of 0.0018 mol. per l. E. D. WILLIAMSON

**Aggregation and disaggregation. Hydrolysis of shellac resin. Hydrogenation of rubber.** C. HARRIES. *Ber.* **56**, 1048-51 (1923).—The EtOH-insol. form of shellac resin can be transformed into the EtOH-sol. form (cf. *C. A.* **17**, 1006) by  $HOAc$  or more readily by  $HCO_2H$ . The resin dissolves in the acid and is pptd. by  $H_2O$  in a form sol. in EtOH and hydrolyzed quantitatively by KOH to a mixt. of hydroxy acids. This disperse phase (the EtOH-sol. form) can be transformed (coagulated) to the inactive aggregate (EtOH-insol. form) by treatment with Et<sub>2</sub>O contg. a little HCl. This is the first evidence that a change in the dispersion of complex org. forms results in a complete change in reactivity. A resin which has hitherto been regarded as unsaponifiable is not necessarily so. It is inferred that the EtOH-insol. phase is a result of coagulation and that during this coagulation several disperse phases are mutually adsorbed to form an aggregate which is of such a structure that it is not readily susceptible to chem. action. Based on the assumption that the capacity of rubber for reacting with H is a function only of its dispersion or aggregation, crude rubber not purified like that of Pummerer and Burkard (*C. A.* **17**, 898) was made very plastic (disaggregated) in a mixing mill and a very dil. soln. made in petroleum-ether with Pt-black, at room temp. It was then reduced under several atm. pressure of H, forming *perhydro-rubber*. This is satd. with respect to Br and has a decompn. temp.  $220-30^\circ$ . Objection is made to the present indefinite use of the term "polymerization," which, where not a strictly chem. condensation of mols. to a mol. of higher mol. wt., should be replaced by the term "aggregation." Aggregation is the mutual adsorption of 2 or more disperse phases. Aggregates are distinguished from polymerized compds. in that an aggregate can be peptized to a disperse phase, whereas true polymers cannot undergo peptization or depolymerization. C. C. DAVIS

**Emulsions of mineral oil with soap and water: the interfacial film.** E. L. GRIFFIN. *J. Am. Chem. Soc.* **45**, 1648-56 (1923).—Emulsions of kerosene in solns. of Na oleate, K stearate, and K palmitate were prepd. and allowed to cream. The amt. of soap

going into the interface was detd. by analyzing the aq. layer for Na or K and the fatty acid. More fatty acid than alkali metal was removed from the soln. unless the soap soln. contained alkali in excess to prevent hydrolysis, in which case alkali metal and fatty acid were removed in equiv. amts. The interfacial area was measured by dilg. the emulsion with water, prepg. a microscope slide by the "hanging drop" method, and counting the no. of particles of the different sizes present, the diams. of the particles being measured by means of an ocular with micrometer disk. On the assumption that the soaps are present in the film in a monomol. layer, the areas occupied by one mol. of the Na oleate, K stearate, and K palmitate were found to be, resp., 48, 27 and  $30 \cdot 10^{-14}$  sq. cm., agreeing closely with the values 46, 22 and  $21 \cdot 10^{-14}$  found by Langmuir for the corresponding fatty acids. The amt. of soap removed is independent of the concn. of the soap soln. used provided that it contains enough soap to supply the unimol. layer. If it does not the emulsion is not stable.

**The composition of foams.** JUSTIN CHATELAN. *J. chim. phys.* 20, 123-31 (1923).—By the bubbling method of Zawidzky (*Z. physik. Chem.* 35, 77; 42, 612) and by a modified method which avoided evapn., attempts were made to verify the Gibbs adsorption formula. Solns. of 0.1 N  $H_2SO_4$ ,  $Na_2CO_3$ ,  $Na_2SO_4$ ,  $PhOH$ ,  $PhNH_2$ ,  $NaOH$ , 0.2 N  $MnSO_4$ , 0.001 N  $PhNH_2$ , and 0.001 N strychnine sulfate were used and saponin was added to promote foaming. It is concluded that the saponin accumulates in the foam and adsorbs the crystalloids so that more crystalloid is found in the surface layer than is to be expected from the Gibbs law.

**Some factors governing the complete sorption of iodine by carbon from chloroform solution.** J. B. FIRTH AND F. S. WATSON. *J. Chem. Soc.* 123, 1219-22 (1923); cf. *C. A.* 16, 2803; 17, 2071.—Four g. of highly active sugar C will bleach 100 cc. of 0.01 N I soln. in a few minutes, while 0.001 N I soln. is bleached immediately. The bleaching in these cases is the result of adsorption. A moderately active C requires several days for complete bleaching, which is therefore the combined result of both adsorption and absorption. The amt. of I which can be retained by the C in contact with pure solvent varies with the concn. of the soln. from which the I was originally sorbed, and appears to be approx. proportional to it. C recovered from previous expts. showed marked increase in activity when freed from I. Both solvent and solute are sorbed by the C, the relative proportions being mainly detd. by the concn. of the I soln. J. M. B.

**Displacement of adsorption.** C. VAN DER HOEVEN. *Collegium* 1923, 159-62.—See *C. A.* 17, 1179.

**Electroendosmosis with carbon filter.** KOJIRO UMETSU. *Biochem. Z.* 135, 442-79 (1923); cf. *C. A.* 15, 1840.—Sulfosalicylic acid is characterized by its especially marked adsorption by blood charcoal. It differs from hitherto examd. strong acids in that the anion is adsorbed more swiftly than the H ion. In sufficiently concd. solns. of this acid, blood charcoal (ampholytoid in the sense of Michaelis) takes on a negative charge, instead of the usual + charge. Thus Michaelis' theory of the dependence of the charge on selective adsorption is supported. The endosmometer of Geymunt is modified and adapted to work with charcoal.

**Electroösmosis.** A. H. W. ATEN. *Chem. Weekblad* 18, 690-2 (1921).—The theory of electroösmosis of liquids through porous solids is discussed, and the vol. passing in unit time shown to be directly proportional to the current density, the dielec. const. of the liquid and the potential difference between the liquid and the porous material, and inversely proportional to the viscosity and cond. of the liquid. The various attempted technical applications of the phenomenon, and of cataphoresis (which term is restricted to the motion of solid particles suspended in a liquid under the influence of the elec. field) are described.

**Improvements in the mode of measurement of osmotic pressure.** ARTHUR GROLLMAN AND J. C. W. FRAZER. *J. Am. Chem. Soc.* 45, 1710-6 (1923).—Cells of very fine texture were prepd. by pptg. insol. silicates within the walls of the Morse and Frazer type of cells heretofore used. Additional support for the  $Cu_2Fe(CN)_6$  membrane is thus produced. Results obtained by the use of the filled cells indicate their superiority to the unfilled cell. A modification of the pressure gage devised by Van Doren, Parker, and Lotz (*C. A.* 16, 862), depending upon the change of  $n$  with pressure as measured by the Zeiss water-interferometer, is described.

**The osmotic pressures of aqueous solutions of phenol at 30°.** ARTHUR GROLLMAN AND J. C. W. FRAZER. *J. Am. Chem. Soc.* 45, 1705-10 (1923).—The authors measured the osmotic pressures of phenol solns. for concns. varying throughout the soly. range at 30°. The results indicate that two mols. of phenol are associated in aq. solns. to form a diphenolic complex. The degree of association increases with higher concns. The associated mols. dissociate with great absorption of heat. L. M. HENDERSON

Contribution to the laws of solubility. ALBERT COLSON. *Compt. rend.* 176, 1552-5 (1923).—A short discussion, semi-polemic. A. E. STRARN

Contraction on solution of various substances in water. JYENDRA NATH RAKSHIT. *Reprint Indian Assoc. Cultivation Sci.* 3, 1-21 (1917).—Making use of data from Landolt and Börnstein's tables, R. has calcd. the contraction which takes place when 100 g. of various substances are dissolved in various quantities of water. The values have been calcd. for  $H_2SO_4$ ,  $HNO_3$ ,  $HCOOH$ ,  $SnCl_4$ ,  $AcOH$ , Me, Et, Pr, isobutyl, and isoamyl alcs., glycerol, acetonitrile, acetone, nicotine,  $NH_3$ ,  $HCl$ ,  $NaOH$  and  $KOH$ ,  $NaCl$ , tartaric acid, chloral hydrate, phenol, sucrose, levulose, dextrose, maltose, and invert sugar. In some cases, the contraction increases with increasing diln., while in others the contraction increases, passes through a max. and then decreases with increasing diln. J. C. S.

Vapor pressure and density of sodium chloride solutions. W. R. BOUSFIELD AND C. E. BOUSFIELD. *Proc. Roy. Soc. (London)* 103A, 429-43 (1923).—The v. p. of aq.  $NaCl$  solns. at  $18^\circ$  has been detd. to the fourth decimal place over the entire range of concns. by direct comparison with the v. p. of  $H_2O$  and the results treated graphically. Pains were taken to secure and maintain air-free solns. The v. p. app. is described in detail. The d. of aq.  $NaCl$  solns. at  $18^\circ$  over the entire concn. range has been detd. to an accuracy of  $\pm 2$  in the fifth decimal place. The pycnometer used was described in an earlier paper (Bousfield, C. A. 2, 1910). For concns. less than 10%  $NaCl$ , the  $d_{15}$  is given by the equation, where  $P$  is the %  $NaCl$  in soln.,  $d_{15} = 0.99862 + 0.007112 P + 0.0000168 P^2$ . An approx. mol. wt. can be calcd. from measurements of the d. and the v. p. lowering of dilute solns. by the formula,  $M = [(P/\delta d) + (\delta p/p\delta d)] \times (18/100) \times i$ , where  $P$  = % concn.,  $\delta$  indicates increment, and  $i$  is an approx. value of the van't Hoff const. A. W. KENNEY

The boiling points of water-alcohol mixtures at various pressures. UGO PRATO-LONGO. *Atti accad. Lincei* 30, II, 419-23; *Chem. Zentr.* 1922, III, 32.—The following data give the vol. % of  $EtOH$ , and the b. p. at 760, 700 and 640 mm., resp.: 0, 100, 97.71, 95.26; 5, 95.9, 93.64, 91.22; 10, 92.6, 90.37, 87.97; 15, 90.2, 88.00, 85.62; 20, 88.3, 86.12, 83.76; 25, 86.9, 84.74, 82.40; 30, 87.5, 83.56, 81.24; 40, 84.1, 81.99, 79.70; 50, 82.8, 80.73, 78.48; 60, 81.7, 79.67, 77.46; 70, 80.8, 78.80, 76.62; 80, 79.9, 77.92, 75.76; 90, 79.1, 77.14, 74.99; 95, 78.24, 76.29, 74.14; 100, 78.30, 76.40, 74.30. C. C. DAVIS

The phenomena of hydrolysis of aqueous solutions of ferric chloride. E. FOXBROU. *Gazz. chim. ital.* 53, 210-5 (1923).—Although the changes that occur in aq. solns. of  $FeCl_3$  have been known a long time the chem. mechanism involved is not yet clear. Antony and Gigli (*Gazz. chim. ital.* II, 1 (1895)) first studied the reaction quantitatively and found that  $FeCl_3$  is hydrolyzed in 3 stages giving  $FeCl_2(OH)$ ,  $FeCl(OH)_2$ ,  $Fe(OH)_3$ . Goodwin (*Z. physiol. Chem.* 21, 1 (1896)) studied the hydrolysis in Kohlrausch's app. and concluded: (1) the mol. cond. of solns. of  $FeCl_3$  increases with the time and the velocity of increase increases with the diln.; (2) the increase in cond. does not take place at once after diln. but only after a certain time, which is greater the greater the concn.; (3) the time necessary to attain a definite value for the equil. increases enormously with the concn. G. interpreted the reaction thus:  $Fe''' + H_2O \longrightarrow Fe(OH)'' + H$ ;  $xFe(OH)'' + 2xFe(OH)' \longrightarrow (Fe(OH)_3)_x$ . P.'s expts. were carried out like those of G. but led him to conclude that the changes are more complex than was heretofore indicated. Solns. of  $FeCl_3$  ( $v = 32, 64, 128, 256, 512, 1024$ ) were prepd. The velocity of hydrolysis at first increases with the diln. to a max. and then diminishes. The reaction takes place in a short time if the solns. are exposed to the sun and requires many days in the dark. In both series the turbidity is greatest in the intermediate solns. while the extremes are quite clear. Under the ultramicroscope the mobile particles are not numerous and are slow moving. A series of expts. was set up in an ice thermostat but the changes in cond. did not show the same course as was observed by G. at  $25^\circ$ . P. found that with a 0.0006  $M$  soln. 1 min. is required before hydrolysis begins; with a 0.0012  $M$  soln. 15 mins.; and with a 0.024  $M$  soln. 45 mins. A much longer latent period is to be expected at  $0^\circ$  but the solns. did not act as expected. Data are given, however, which show that the cond. values oscillated continually for 8 days and especially during the first few days. After 8 days they were more nearly constant. This phenomenon was not interpreted. The observations are to be extended and published in detail. E. J. WITZEMANN

The vapor-pressure lowering of certain metallic salts in aqueous solution at zero degrees. C. DIETRICH. *Ann. Physik* 70, 617-21 (1923).—The sulfates of Cd, Zn, and Ni at low concns. show a smaller vapor pressure lowering than non-electrolytes at the same concns. At about double molar concn. the two values are about the same,

while for higher concns. the salts show a higher v. p. lowering than non-electrolytes. The sulfate of Mg has been shown to behave the same, though the concn. range of its abnormal behavior is smaller. The nitrates and chlorides of Cd, Zn and Ni, on the other hand, have v. p. lowerings greater than non-electrolytes throughout their entire range of concns. This behavior of sulfates is exhibited at 100° as well as at 0°.

A. E. STEARN

**The conditions for the maximum precipitation of an amphoteric electrolyte.** ADA PRINS. *Chem. Weekblad* 18, 657-8(1921).—The min. soly. occurs at a definite hydroxyl-ion concn. depending for each amphoteric electrolyte on its soly. product as base and as acid. The concns. of the positive and negative ions are inversely proportional to their charges.

J. C. S.

**The acidity of hydrogen telluride.** M. DE HLASKO. (A) *Ext. bull. acad. Polonoise sci. lettres* [A], 1919, 73-8; (B) *Chem. Zentr.* 1923, I, 15-6.—To det. the dissoc. const. of  $H_2Te$  the elec. cond. of its  $H_2O$  solns. was measured.  $H_2Te$  was prepd. by the electrolysis of  $H_2SO_4$  with a Te cathode, and measurements were made as rapidly as possible in a H atm. to avoid decompn. The mobility of the  $(H_2Te)$  ion was 61. The soln. was run into excess NaOH, the Te pptd. by a current of air, the filtrate acidified several times and treated while hot with  $SO_3$  until pptn. of Te was complete. Measurements were made at 18° with a max. concn. of 0.1 N, giving  $K = 2.27 \times 10^{-3}$ .  $H_2Te$  is, therefore, more dissociated than  $H_2F_2$ . The value of  $K$  for  $H_2Te$  compared with that of  $H_2Se$  [see following abstr.] shows that the H compds. of elements of the 6th and 7th group dissociate in  $H_2O$  more as the at. wt. increases. **The acidity and the electrolytic dissociation of hydrogen selenide.** *Ibid* (A), 1921, 18-25; (B), 1923, I, 16.—Detns. were made of the mobility of  $(HSe)^-$  and of the cond. of various aq. solns. of  $H_2Se$ . Com. Se was purified by pptn. from  $H_2SO_4$  by  $SO_3$ , and  $H_2Se$  was prepd. from  $Al_2Se_3$  and  $H_2O$ . By conducting  $H_2Se$  into aq. NaOH and driving off the excess  $H_2Se$  with H, an almost neutral soln. of  $NaSeH$  was obtained. Cond. measurements were made at 25° in a H atm. and were accurate to 1%. The mobility of the  $(HSe)$  ion was 70. The concns. of 0.1 N and of lower concns. of  $H_2Se$  were detd., giving  $K = 1.88 \times 10^{-4}$ . Calcs. of the dissocn. of  $H_2Se$  from  $K$  were in good agreement with the value obtained from the difference in cond. of a pure  $NaSeH$  soln. and one satd. with  $H_2Se$ .

C. C. DAVIS

**The electrolytic dissociation of hydrogen selenide and hydrogen telluride.** *J. chim. phys.* 20, 167-72(1923).—See preceding abstracts.

B. S. NEUBAUSSEN

**Effect of sucrose on the activities of certain ions.** J. W. CORRAN. *J. Am. Chem. Soc.* 45, 1627-36(1923).—From the results of e. m. f. measurements, the conclusion reached in an earlier paper that the  $K^+$  and  $Cl^-$  ions are sol. in water of hydration of sucrose has been verified. The transport no. of the  $K^+$  ion in sucrose solns. remains const. up to 50%  $C_{12}H_{22}O_{11}$ , but appears to increase slightly in 60 and 70% solns. The  $Ba^{++}$  ion also is sol. in the water of hydration of sucrose. Since the soly. or insoly. of an ion in water of hydration is of primary importance in detg. its true concn., in terms of available  $H_2O$ , Harned's extension to any ion of the MacInnes postulate regarding the independent activity of the  $Cl^-$  ion in solns. of univalent chlorides of the same concn. is only valid for those ions which are sol. in the water of hydration of secondary solutes.

H. JERMAIN CREIGHTON

**Speed of reaction in concentrated solution and the mechanism of the inversion of sucrose.** II. GEORGE SCATCHARD. *J. Am. Chem. Soc.* 45, 1580-92(1923); cf. C. A. 16, 672.—A kinetic interpretation of activity is given which justifies the expression of reaction speed in terms of activities and which demands that the speed so expressed be defined as moles transformed in 1 mole of all components. This interpretation offers a possible explanation of the salt effect on reaction speed. Any interpretation of the expts. depends on the assumption that the liquid-junction potential with satd. KCl is independent of the sucrose concn. Interpreted by the formula previously presented, the speed of the inversion of sucrose catalyzed by HCl adds confirmation that 6 mols. of  $H_2O$  react with each mol.  $C_{12}H_{22}O_{11}$ .

H. JERMAIN CREIGHTON

**The behavior of the most important carbohydrates in strong acids, alkalis, and in solutions containing sulfite and bisulfite.** I. The inversion of lactose by strong acids. B. BLEYER AND H. SCHMIDT. *Biochem. Z.* 135, 546-57(1923).—The speed of inversion of lactose in concd. HCl,  $HClO_4$  and  $H_2SO_4$  at 15-40° follows the equation for a mono-mol. reaction. With 10° rise in temp.  $K$  increases fourfold.

G. E. SIMPSON

**The peroxidation of nitric oxide.** II. E. BRINER AND G. MALET. *J. chim. phys.* 20, 173-200(1923).—The rate of oxidation of NO by  $O_3$  was detd. for mixts. of the following concn.: 2% NO, with 2%, 4% and 21%  $O_3$ ; and 4% NO, with 4%, 8% and 21%  $O_3$ . The diluent of the gas mixts. was  $N_2$ , and the reaction products were absorbed in 3 N NaOH or in concd.  $H_2SO_4$ . Inasmuch as absorption is not complete, correction



curves were detd. for the conditions used. The low gas concn., and the consequent low reaction velocity made it possible to study the reaction rate when the NO was less than 50% oxidized. This region had not been explored previously. The results show that the reaction is of the third order, and proceeds in a single stage,  $2\text{NO} + \text{O}_2 = 2\text{NO}_2$ . Any  $\text{N}_2\text{O}_5$  in the reaction products is due to secondary reactions. In the third-order equation,  $dx/dt = K(b-x)^2(a-x)$ , the abs. velocity const.,  $K = 1.61 \times 10^{-4}$ . With a large excess of  $\text{O}_2$ , at least 20 times the theoretical amt., the reaction is practically bimol. By using the bimol. equation and expressing the concn. in vol.-%, there is obtained,  $K = (1/t)/[x/(b-x)]$ , in which  $K = 0.032$ . This simpler equation may be used for many practical calcs. where air is the oxidizing agent, e. g., in the recovery of nitrous gases obtained by the fixation of  $\text{N}_2$  in the arc.

R. H. LOMBARD

**Energy of activation in heterogeneous gas reactions with relation to the thermal decomposition of formic acid vapor.** C. N. HINSHELWOOD AND BRYAN TOPLEY. *J. Chem. Soc.* 123, 1014-25(1923).—Heat of activation is the energy required to enable a mol. to undergo chem. decompn. and is connected with the velocity const.,  $k$ , by the equation  $\log k/dT = E/RT^2$ . The heat of activation of the formic acid mol. for the reaction  $\text{HCOOH} = \text{CO} + \text{H}_2\text{O}$  on Ti oxide is found to be much greater than for the same reaction on glass, so that the magnitude of the heat of activation cannot be regarded as an inherent property of the mol. For the alternative reaction  $\text{HCOOH} = \text{CO}_2 + \text{H}_2$  at a no. of catalytic surfaces, the value of  $E$  shows a lack of accord with  $K$ . Two possible interpretations are pointed out. Either it may be assumed that a mol. must not only possess the crit. energy but must be in a certain phase before it decomposes, or the whole lack of correlation between  $E$  and  $k$  may be referred to the very widely differing fractions of the various catalytic surfaces which are actually covered with adsorbed mols.

JAMES M. BELL

**A study of the oxidation of copper and the reduction of copper oxide by a new method.** W. G. PALMER. *Proc. Roy. Soc. (London)* 103A, 444-61(1923).—A film of Cu on a china-clay rod was prepd. according to the method described earlier (*C. A.* 16, 2440). The course of the oxidation or reduction was then followed by measuring the elec. cond. of the film, after proving that the cond. measured its metal content. Oxidation in pure oxygen showed the rate to be const. at const. temp. ( $T$ ) and pressure ( $p$ ). At  $p < 300$  mm. the rate varies as  $\sqrt{p_{\text{O}_2}}$ , but at higher pressures the rate is independent of  $p$ . Hence it follows that  $\text{O}_2$  condenses on the metal as simple atoms, that above 300 mm. the film is satd., and that  $\text{Cu}_2\text{O}$  forms from the interaction of 2 Cu atoms with 1 O atom. At approx.  $165^\circ$   $\text{Cu}_2\text{O}$  begins to oxidize to  $\text{CuO}$ . Oxidation in the presence of  $\text{H}_2$  or CO showed the rate of oxidation was initially lower, but rose to much higher values than for pure  $\text{O}_2$ . Conclusion:  $\text{H}_2$  and CO condense on the metallic surface and combine directly with the condensed  $\text{O}_2$ , and this reaction activates the Cu atoms by partially withdrawing electrons from them. Reduction of  $\text{CuO}$  with pure CO showed the rate to be proportional to the Cu present in the film, whence P. concludes that CO is first adsorbed on the Cu and then reduces adjacent mols. of oxide. Reduction of  $\text{CuO}$  with pure  $\text{H}_2$  showed the rate to sink rapidly to a very low value, but on the addn. of fresh  $\text{H}_2$  the reaction started again with renewed activity. This is explained as due to the formation of water mols. which adhere to two adjacent Cu atoms preventing them from adsorbing further  $\text{H}_2$ . P.'s views on the mechanism of the reactions with  $\text{H}_2$  are not in harmony with those of Pease and Taylor (*C. A.* 16, 522, 3422, 3793).

A. W. KENNEY

**Mechanism of the action of hydrogen chloride on alcohol.** S. KILPI. *Ann. acad. sci. Fennicae* 16A, No. 3, 27 pp.(1920).—The reaction  $\text{C}_2\text{H}_5\text{OH} + \text{HCl} \rightleftharpoons \text{C}_2\text{H}_5\text{Cl} + \text{H}_2\text{O}$  is studied from the points of view of reaction velocity, cond. and dissoc. at  $110^\circ$ . The results of the exptl. work are shown in 12 tables. Over 20 mathematical equations are discussed. From the results of measurements of the reaction velocity in the action of HCl on EtOH in soln. contg. an excess of  $\text{H}_2\text{O}$  in proportion to the HCl, reaction-velocity equations may be written as follows: In chloride-free solns.  $ds/dt = [c_1^{(\text{H}^+)}a + c_1^{(\text{HCl})}(1-a)]a(B-z)^2 - C_2z$ . In chloride-contg. solns.  $ds/dt = [c_1^{(\text{H}^+)}a + c_1^{(\text{HCl})}(1-a)](B-z) - C_2z$ . In these equations  $B$  denotes the original HCl concn.,  $a$  the degree of dissoc.,  $c_1^{(\text{H}^+)}$  and  $c_1^{(\text{HCl})}$  the velocity consts. with regard to the action of HCl on EtOH, of which consts. the former denotes the H ion and the latter the undissociated HCl mol.,  $s$  denotes the concn. of the EtCl, and  $C_2$  the velocity const. with regard to the decompn. of the EtCl formed. These equations are to be interpreted thus: In the action of HCl on EtOH the Cl ion reacts with EtOH according to the equation  $\text{Cl}^- + \text{EtOH} \rightarrow \text{EtCl} + \text{OH}^-$ , HCl catalytically accelerates this reaction, and the un-

dissociated HCl mols. participate in the reaction by yielding H ions which act catalytically. With regard to the decompn. of EtCl the above equations hold when this decompn. happens according to the equation  $\text{EtCl} + \text{H}_2\text{O} \longrightarrow \text{EtOH} + \text{HCl}$ , and the HCl from this reaction does not act to accelerate catalytically. L. W. RIGGS

**Catalysis. XVIII. Remarks concerning the phenomena of induction.** N. R. DHAR. *Z. anorg.-allgem. Chem.* **128**, 207–11 (1923); cf. *C. A.* **15**, 2029. — (1) The reaction between  $\text{HIO}_3$  and  $\text{H}_2\text{SO}_4$  exhibits an induction period and has a greater velocity at higher temp. Since previous work has shown that the reaction between  $\text{HIO}_3$  and HI is not greatly influenced by temp. and is accelerated by H ions it is concluded that the present reaction takes place in two stages, (a)  $\text{HIO}_3 + 3\text{H}_2\text{SO}_4 = 3\text{H}_2\text{SO}_5 + \text{HI}$  which is relatively slow and favored by increase in temp., and (b) the reaction between HI and  $\text{HIO}_3$ . The reaction is autocatalytic because the  $\text{H}_2\text{SO}_5$  formed increases the H-ion concn. and thereby the rates of (a) and (b). Similar phenomena are observed when the  $\text{H}_2\text{SO}_4$  is replaced by  $\text{As}_2\text{O}_3$  or  $\text{SnCl}_2$ . No induction period is observed when  $\text{FeSO}_4$ ,  $\text{K}_4\text{Fe}(\text{CN})_6$ ,  $\text{HNO}_3$ , hydrazine or hydroxylamine hydrochlorides are used as reducing agents. Formic acid,  $\text{H}_3\text{PO}_4$  and  $\text{H}_3\text{PO}_3$  are practically without action on  $\text{HIO}_3$ . (2) An induction period is observed in the reaction between  $\text{Na}_2\text{S}_2\text{O}_3$  and salts of As, Sb, Bi, Ag, Cd or Cu. Higher temp. favors these reactions. The thiosulfuric acid is thought to decompose, forming  $\text{H}_2\text{S}$  and tetrathionic acid, the  $\text{H}_2\text{S}$  then acting on the metal salt. (3) Hydrogenation reactions catalyzed by Pt and Pd do not proceed unless the metals contain some  $\text{O}_2$ . This is considered a case of induced reactions, the primary reaction being between  $\text{H}_2$  and  $\text{O}_2$ . F. L. BROWNE

**Accelerators of oxidation. I. Action of ferric sulfate upon potassium permanganate.** BUNSUKE SUZUKI and CHUJIRO HAMADA. *J. Chem. Soc. Japan* **44**, 117–66 (1923). — The velocity of oxidation of  $\text{H}_2\text{C}_2\text{O}_4$  by  $\text{KMnO}_4$  was measured by measuring the time required to decolorize  $\text{KMnO}_4$ . To 3 cc. 0.1 *N*  $\text{H}_2\text{C}_2\text{O}_4$ , 2.5 cc. 0.1 *N*  $\text{KMnO}_4$  and 25 cc. *N*  $\text{H}_2\text{SO}_4$ , various amts. of 0.004 *M*  $\text{Fe}_2(\text{SO}_4)_3$  are added and made up to 50 cc. (brown bottles were used). The curve of velocity plotted against cc. of  $\text{Fe}_2(\text{SO}_4)_3$  has sharp breaks which occur at regular intervals (at 1, 2, 3, 4 equiv. concns. of Fe against 2 equivs.  $\text{KMnO}_4$ ). If the  $\text{H}_2\text{C}_2\text{O}_4$  concn. is changed there is no change in position of the breaks, but change in  $\text{KMnO}_4$  always produced the same breaks at multiple concns. of 1 equiv.  $\text{Fe}_2(\text{SO}_4)_3$  against 2 equivs.  $\text{KMnO}_4$ . Increase in  $\text{H}_2\text{C}_2\text{O}_4$  retards the general velocity, its extent being greater as  $\text{Fe}_2(\text{SO}_4)_3$  increases. Without the Fe salt, an increase in  $\text{H}_2\text{C}_2\text{O}_4$  retards velocity, while acidity increases acceleration of velocity. It is noted, however, that the velocity at intermediate periods is greatly accelerated when  $\text{H}_2\text{C}_2\text{O}_4$  is increased. Since a brown ppt. appears simultaneously with disappearance of  $\text{KMnO}_4$  around the point of the max. velocity, it is assumed that the end reaction must be due to  $\text{Mn}(\text{OH})_4$ . Therefore, the oxidation of  $\text{H}_2\text{C}_2\text{O}_4$  with  $\text{Mn}(\text{OH})_4$  was studied. There is an intermediate production of complex salts formed between  $2\text{Mn}(\text{OH})_4$  and  $\text{H}_2\text{C}_2\text{O}_4$  which detrs. the velocity of the oxidation. Acceleration by  $\text{Fe}_2(\text{SO}_4)_3$  is due to its entrance into complex-salt formation with  $\text{H}_2\text{C}_2\text{O}_4$ . It is assumed that such complex salts accelerate the oxidation by absorbing infra-red light. S. T.

**Oxidase-like action of complex salts of metals. II. Chemical kinetics of oxidation by the catalytic action of complex salts.** YUJI SHIHATA and HIDEO KANEKO. *J. Chem. Soc. Japan* **43**, 833–84 (1922); cf. *C. A.* **14**, 2590. — The velocity const. of oxidation at 25° of pyrogallol in the presence of 15 complex Co salts is reported. The oxidation was measured by diminution of the vol. of  $\text{O}_2$ . 0.004 *M* pyrogallol and 0.002 *M* complex salts were used. The conclusions are: With purpureo salts,  $[\text{Co}(\text{NH}_3)_2\text{Cl}]\text{Cl}_2$ ,  $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{SO}_4$ ,  $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$ ,  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})\text{Cl}_2]\text{Cl}$ ,  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{Cl}]\text{SO}_4$ , and  $[\text{Co}(\text{NH}_3)_3\text{OH}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ , the reaction starts immediately and follows a monomol. law. Roseo salts,  $[\text{Co}(\text{NH}_3)_2\text{SCN}]\text{Cl}_2$ ,  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_2(\text{C}_2\text{O}_4)4\text{H}_2\text{O}]$ ,  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})]\text{Cl}_2$ , and  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_2(\text{SO}_4)_3 \cdot 3\text{H}_2\text{O}]$ , are inactive for a few minutes, then reaction suddenly starts following a monomol. type. The total reaction, therefore, is of 2 types. Nitro salts,  $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)_2]\text{Cl}_2$ ,  $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)_2]\text{Cl}$ , and  $[\text{Co}(\text{NH}_3)_2(\text{C}_2\text{O}_4)(\text{NO}_2)_2]\text{Na} \cdot 2\text{H}_2\text{O}$ , are very ineffective, their catalytic power decreasing with an increase in the no. of  $\text{NO}_2$  groups. These results confirm S.'s contention that the catalytic power of the complex salts is proportional to their degree of instability in  $\text{H}_2\text{O}$ , that oxidation itself is autooxidative, and that union between  $\text{H}_2\text{O}$  and  $\text{O}_2$  precedes. The activation of  $\text{H}_2\text{O}$  is brought about by free energy given off during changes from unstable complex salt to stable form in  $\text{H}_2\text{O}$ . The optimum concn. of these salts for purposes of catalysis is 0.002 *M*; above this retardation occurs. Below this approx. concn. the ratio of velocities between two concns. is  $K_1/K_2 = (C_1/C_2)^b$ , where  $b = 0.10$ . The effect of temp. on the catalytic power is proportional to the degree of stability of these salts in  $\text{H}_2\text{O}$ . The curves of the velocity const. of nitro salts

at high temps. are similar to those of roseo and purpureo salts. H ions, non-catalytic complex salts and  $\text{HgCl}_2$  all act as poison. That the retarding action of non-catalytic complex salts is due to complex compd. formation with the oxidizable compd. (pyrogallol), is demonstrated by spectral analysis. III. **Decomposition of hydrogen peroxide by complex salts of metals.** *Ibid* 44, 186-89 (1923).<sup>2</sup>—Unstable complex salts which are very active catalyzers for the oxidation of pyrogallol, decompose  $\text{H}_2\text{O}_2$ , while Co complex salts that are not very active show a very weak catalase-like action. The chem. kinetics of this action were studied with  $[\text{Ni}(\text{NH}_4)_4]\text{Cl}_2$  and  $[\text{Cu}(\text{NH}_4)_4]\text{Cl}_2$ .  $\text{H}_2\text{O}$ , both of which are very unstable in  $\text{H}_2\text{O}$ . To  $1/200$  M soln. of these salts, 25 cc. dild.  $\text{H}_2\text{O}_2$  are added and O evolved in the decompn. is measured. The decompn. of  $\text{H}_2\text{O}_2$  by these salts is monomol. in neutral soln.; in alk. soln., there is a max. point; free H ions retard the action. The velocity const. of two diff. concns. of the salts show the relationship  $K_1/K_2 = (C_1/C_2)^b$ , where  $b = 1.30$ . The temp. coeff. is 1.77. The relation between temp. and velocity const. follows van't Hoff and Arrhenius' formula with  $A = 2665$ . The poisonous actions of various substances ( $\text{HgCl}_2$ , KCl,  $\text{KClO}_3$ , KCN,  $\text{K}_4\text{Fe}(\text{CN})_6$  and acidified  $\text{ZnSO}_4$ ) are inversely proportional to the concns. of the complex salts. Various aspects of catalase-like action of complex salts of metals are compared to those of the action of colloidal Pt reported by Bredig. S. T.

**Catalytic oxidation with salts of copper and uranium.** J. ALOY AND A. VALDIGUIE. *Bull. soc. chim.* 33, 572-6 (1923).—Cu salts show the action of oxidase enzymes in producing a characteristic blue color with hydroquinone in the presence of O. Pyrogallol shaken in the presence of Cu absorbs O and evolves  $\text{CO}_2$ .  $\text{Cu}(\text{OAc})_2$  catalyzes the oxidation of glucose in the presence of air. Tincture of guaiacum is colored blue by Cu salts, a very delicate test at  $60^\circ$ . Guaiaconic acid soln. permits of the detection of 1 part Cu in 80,000 in the case of the chloride, and 1 part in 40,000 as the acetate. Cu lactate, succinate, or nucleate in Na nucleate soln., but not the tartrate or citrate, colors guaiaconic acid. The Cu salt is hydrolyzed to  $\text{CuO}$ , which is the active oxidizing catalyst. In the character of peroxidases, Cu salts decompose  $\text{H}_2\text{O}_2$  in the usual peroxidase reactions.  $\text{CuSO}_4$  soln., too dil. to color tincture of guaiacum, does so if a drop of  $\text{H}_2\text{O}_2$  is added, the sensibility reaching 1 part Cu in 100,000. Cu salts which do not act directly on guaiacol give a red coloration with phenolic ether in the presence of  $\text{H}_2\text{O}_2$ . Cu salts in the presence of  $\text{H}_2\text{O}_2$  color blue alc. solns. of pyramidone, indigo carmine, and benzidine. Also, like certain peroxidases, Cu salts facilitate the decompn. of KI by  $\text{H}_2\text{O}_2$ . These reactions point to an unstable Cu peroxide; this was prepd. and found to give the above reactions. In the absence of O, U salts in the presence of light effect simultaneous oxidation and reduction as do oxido-reductases. U acetate soln. does not act upon glucose or methylene blue, but if a U acetate soln. is exposed to sunlight in a vacuum with 1% glucose (O acceptor) and methylene blue (H acceptor), the latter is decolorized and the glucose is partly oxidized. On the introduction of air, the blue reappears, and may again be destroyed by exposure to sunlight.  $\text{H}_2\text{O}$  is apparently decomposed, the H ion reducing the methylene blue, and the OH ion oxidizing the glucose. The energy necessary to the reaction is derived from the sunlight. Alcohols, aldehydes and sugars act as O acceptors, but not phenols. C. B. EDWARDS

**The problem of negative catalysis.** I. H. S. TAYLOR. *J. Phys. Chem.* 27, 322-41 (1923).—Negative catalysis, by inorg. and org. compds. in such cases as the autoxidation of  $\text{HCHO}$ , oils, rubber, and animal tissue, the effect of  $\text{H}_2\text{O}$  on the decompn. of  $(\text{CO}_2\text{H})_2$  in  $\text{H}_2\text{SO}_4$  of  $\text{Et}_2\text{O}$  on the oxidation of Mg alkyl halides, etc. has not been explained either by the suppression of a positive catalyst (cf. *Z. phys. Chem.* 45, 641 (1903)) or by the simultaneous reaction of 2 forms of the reacting mols. (cf. *C. A.* 5, 3053). Such reactions are explained by the simultaneous interaction of the inhibitor with 1 of the reacting compds. to form a mol. compd. which subsequently decomposes, regenerating inhibitor and reactant, without change in the latter. For marked inhibition to occur, the rate of reaction between inhibitor and reactant must be rapid compared with the rate of the inhibited reaction. The influence of  $\text{H}_2\text{O}$  on the rate of decompn. of  $(\text{CO}_2\text{H})_2$  in  $\text{H}_2\text{SO}_4$  is discussed in detail in explanation of this hypothesis. The conditions necessary for successful inhibitory power where B is an inhibitor of a reaction between A and C giving AC, in virtue of the capacity of A to form the mol. AB are as follows: The A mols. can react (1)  $\text{A} + \text{C} \rightarrow \text{AC}$  or (2)  $\text{A} + \text{B} \rightarrow \text{AB}$ . The extent of (1) is detd. by the concn. of B (by  $K$  in the equil.  $K = \frac{[\text{A}][\text{B}]}{[\text{AB}]}$ ) and by the rate of (2) (rate  $\text{A} + \text{B} = K(\text{A})(\text{B})$ ). Hence the inhibitory power of a compd. depends on the actual concn. of the inhibitor and on its speed of reaction with the principal reacting compd. to form the mol. compd. Though the velocities of mol. compd. formation are too rapid to have yet been detd., the results indicate that individual velocities may be widely different. The mechanism of negative catalysis is the

opposite of that of intermediate compd. formation. In positive catalysis the reactants form the final compd. through the intermediate more rapidly than in the absence of the catalyst. In negative catalysis, formation of the intermediate compd. retards the reaction rate because 1 or more reactants are diverted from the main reaction and the energy is consumed. The theory emphasizes the fact that the concn. of a compd. is not its active mass, but a very much greater amt. C. C. DAVIS

**Poisoning phenomena in chemical reactions, particularly solution of metals in acids.** A. SILVERTS AND P. LUGG. *Z. anorg. allgem. Chem.* 126, 193-225(1923).—The effectiveness of various org. compds. in repressing soln. of metals in HCl and H<sub>2</sub>SO<sub>4</sub> was studied quantitatively. In confirmation of Vogel's Ger. pat. 309,264 it was found that compds. contg. pyridine-like N exert such repressive action. In the series pyridine, quinoline, naphthoquinoline the toxic action increased with mol. wt. strongly in accordance with Traube's rule. An ext. contg. the basic Et<sub>3</sub>O-sol. components from crude anthracene (av. mol. wt. = 200) proved most effective of all; in decreasing toxicity followed  $\alpha$ - and  $\beta$ -naphthoquinoline (acridine), strychnine, brucine, narcotine, quinine nicotinic and veratrine. With exception of novocaine and HCN, substances without a pyridinic N atom had no effect. Similar results were obtained with Fe, Al and Zn. As a measure of the velocity of soln. was taken:  $K = [\sqrt{B-x_1} - \sqrt{B-x_2}]/(t_1-t_2)$ , where  $B$  = vol. of H<sub>2</sub> equiv. to original wt. of metal;  $x_1$  and  $x_2$  = vols. of H<sub>2</sub> evolved at times  $t_1$  and  $t_2$ ;  $\sqrt{B-x_1}(x_2)$  is a measure of the metal surface at the time  $t_1(t_2)$ . Exptl. agreement with this equation was good in Fe + HCl, imperfect with Fe + H<sub>2</sub>SO<sub>4</sub> and Al + HCl. The (percentage) repressive effect of a poison is given by  $100(K_0 - K_p)/K_0$ , where  $K_0$  and  $K_p$  are the consts. for unpoisoned acid and the same acid with the concn.  $c$  of poison. The soln. velocity of Fe in HCl at 78° increases approx. with the third power of the concn. of acid. Temp.-coeff., 50-78° = 2.0-2.3 per 10°. Rise of temp. decreases the effect of toxic substances when their concn. is small but has no effect on large concns. The relation between concn. of toxic substance and the consts.,  $K_0$  and  $K_p$ , could be expressed, with agreeing results for "extract,"  $\alpha$ -naphthoquinoline and strychnine, by the adsorption equation,  $(K_0 - K_p)/K_p = acb$ , where  $a$  and  $b$  are consts. which change with the kind of poison. The equation does not hold when the repression due to the poison is greater than 75-85%. (Cf. Bredig, *Z. physik. Chem.* 37, 1, 323(1901).) The soln. velocity of Al in HCl at 20° increases much more rapidly than the acid concn. Rise of temp. from 20° to 30° increases the soln. velocity 1.4 times; it has no effect on strongly poisoned solns. The soln. of Al has a pronounced induction period. The max. velocity is reached as soon as a definite fraction of the metal is dissolved. The value of this fraction is within wide limits independent of acid concn. and poison adds. Toxication and detoxication of the metal are completed very rapidly. The effect of various poisons on the potential of H<sub>2</sub> sepn. on different metals was studied by plotting the current density potential curves in 1 N H<sub>2</sub>SO<sub>4</sub>. Concns. of poisons were mostly greater than those used in the soln. researches.  $\alpha$ -Naphthoquinoline exerted only a slight effect; "extract" increased the overvoltage on Ni, Fe and Cu but had less effect on Hg, Ag and Pb. No effect was produced on platinized Pt. No clear relation between repression of soln. velocity and increase of overvoltage could be noted. Conclusion: Through adsorption of the poison part of the metal surface is rendered inactive and in consequence the soln. velocity is retarded. A. R. MIDDLETON

**The acid-base equilibrium in simple two-phase systems.** C. D. MURRAY. *J. Biol. Chem.* 56, 569-61(1923).—"The distribution law and the law of mass action (Henderson's equation) have been combined to yield equations expressing the relation between the distribution of a weak acid between 2 phases, one of which is an aq. soln., and the  $p_H$  of the aq. phase." Application of these equations to the sepn. of weak acids from one another, to the discussion of the buffer properties of 2-phase systems, to soap solns., and to the question of the condition of the Ca in the blood are discussed. I. GREENWALD

**Equilibrium of tungsten and its oxides with hydrogen and water vapor; carbon monoxide, carbon dioxide and oxygen.** Correction. J. A. M. VAN LEMPT. *Z. anorg. allgem. Chem.* 126, 226(1923); cf. C. A. 16, 1530.—In the article, p. 274, should be read  $p_1^2 = K_p K_1^2$  instead of  $K_p K_1$  and similarly in the equations for  $p_2$  and  $p_3$ . Then the equations p. 275 (abstr., line 20) become  $\log p_1 = -(27982/T) + 7.81$ ;  $\log p_2 = -(27394/T) + 7.88$ ;  $\log p_3 = -(30696/T) + 12.42$ . Then  $Q_1 = 127900$  cal.;  $Q_2 = 128200$  cal.;  $Q_3 = 140400$  cal. The conclusions drawn are not affected. The calcn. on p. 276 gives 132800 cal. A. R. M.

**System lead-antimony.** R. S. DRAN. *J. Am. Chem. Soc.* 45, 1683-8(1923).—Sb is sol. in solid Pb up to between 2 and 3% of Sb at the eutectic temp. The alloys

contg. up to 13% show a higher eutectic temp. on heating than on cooling.

H. JERMAIN CREIGHTON

The use of graphical calculations for mixtures. The graphical representation of mixed acids. E. BERL and O. SAMTLER. *Z. angew. Chem.* 35, 270-1 (1922).—Tri-angulation graphs are given from which the compn. of the system  $HNO_3-H_2SO_4-H_2O$  can be detd.

C. C. DAVIS

Thermal analysis of the system sulfur-*p*-dichlorobenzene. G. BRUNI and C. PELIZZOLA. *Atti accad. Lincei* 30, ii, 158-62; *Chem. Zentr.* 122, III, 18.—The results are given in tables and curves. The eutectic temp. is approx.  $51^\circ$  for a concn. of somewhat over 5% S. Up to approx. 40% S ( $97.1^\circ$ ), cryst. S. seps. Between 40 and 78% S ( $97.1-98.4^\circ$ ) turbidity first appears at higher temps. and crystn. only at  $97^\circ$ . Between 78 and 100% S ( $99-113^\circ$ ) monoclinic S seps. The miscibility curves for S in  $C_6H_6$ ,  $PhCl$  and  $p-C_6H_4Cl_2$  were detd. In  $p-C_6H_4Cl_2$  as in all normal solvents the S mol. is  $S_8$ .

C. C. DAVIS

The three-component system: lime, silica and alumina. R. GRÜN and K. BIEHL. *Zement* 12, 10-1, 18-9, 26-7, 34-5, 44-5, 111-3, 120-1, 126-7 (1923).—A phase-rule diagram and a space diagram of the system  $CaO$ ,  $SiO_2$ , and  $Al_2O_3$  are given.  $3CaO \cdot SiO_2$ ,  $2CaO \cdot SiO_2$ ,  $3CaO \cdot 2SiO_2$ , and  $CaO \cdot SiO_2$  are the compds. formed by  $CaO$  and  $SiO_2$ .  $3CaO \cdot Al_2O_3$ ,  $5CaO \cdot 3Al_2O_3$ ,  $CaO \cdot Al_2O_3$ , and  $3CaO \cdot 5Al_2O_3$  are formed by  $CaO$  and  $Al_2O_3$ .  $Al_2O_3 \cdot SiO_2$  is formed by  $Al_2O_3$  and  $SiO_2$ .  $2CaO \cdot Al_2O_3 \cdot SiO_2$  and  $CaO \cdot Al_2O_3 \cdot 2SiO_2$  are formed by the 3 substances. Photomicrographs have been made of various mixts. of the system which show that all of the above compds. have definite cryst. structures. The phys. properties of all the compds. are given. R. F. SCHNEIDER

The constant-volume gas thermometer. F. G. KEYES. *J. Math. Phys.* 1, 89-102 (1922).—The error due to adsorption on the walls of the container bulb of a gas thermometer at low pressures is noted. Thus, measurements of  $(d p/dt)_T$  at different temps., to det. the equation of state for low pressures, may be misleading unless absorption effects are eliminated. For  $N_2$  and  $H_2$  the pressure is a linear function of the abs. temp. The coeff. for  $CO_2$  plotted against the reciprocal abs. temp shows some curvature in the direction which would be caused by adsorption. When adsorption is eliminated, corrections for the const. vol. scale could only arise from association or dissociation of the mols. of the thermometric gas. The equation is developed for this condition, and it is shown that the present expansion coeffs. between the ice and steam points for the thermometric gases are given within the limits of accuracy by means of the several equations of state whose consts. have been evaluated at high pressures, where the pressures are linear functions of the abs. temp. The conclusion is drawn that the mol. association term in the formula deduced for the temp. of melting ice on the abs. temp. scale must exert an effect less than 1 part in 10,000, which is the limit of accuracy of the present expansion coeffs., and this accuracy corresponds to about  $0.03^\circ$  in the temp. of the ice point. Corrections are calcd. for the const.-pressure scale for  $H_2$ , He, and  $N_2$  on the basis of the equation of state giving pressure as a linear function of the temp. The  $N_2$  and  $H_2$  corrections agree well with those of Buckingham obtained from Joule-Thomson measurements. Berthelot's corrections are too low in the case of  $H_2$ .

S. L. CHISHOLM

Braun's law and thallous sulfate. FUSAO ISHIKAWA. *J. Chem. Soc. Japan* 44, 220-3 (1923).—A theoretical paper. It is shown that Braun's law can be applied for calcn. of heat of dissoln. and vol. change on dissoln. of  $Tl_2SO_4$  (*C. A.* 17, 486, 672). The results showed close agreement with those reported before. S. T.

New data on thermochemistry. WOJCIECH SWIENTOSLAWSKI. *Bull. soc. chim.* 29, 496-9 (1921).—Combining his own results (*C. A.* 5, 1414, 1415; *Bull. Acad. Sci. Cracow* 1909, 941-72) with those of Fajans (*C. A.* 14, 1623), S. deduces values for the heat of formation of any linking such as  $(C-X)$  or  $(H-X)$  and shows that it may be considered as made up of two parts, one part being produced by the atom  $(C-)$  or  $(H-)$  and the other by the atom to which it is linked. Values are calcd. for C and the halogen atoms. It is shown that the heat produced by the atom in the formation of a compd.  $X-Y$  is not always equal to the heat produced by it in the formation of the simple mol.  $X-X$ .

J. C. S.

A new constant characterizing the system vapor-liquid. WOJCIECH SWIENTOSLAWSKI. *Bull. soc. chim.* 29, 507-12 (1921); cf. preceding abstr.—The value of  $B$  in the equation  $B = d_v^2/T \log K$ , where  $d_v$  is the density of the liquid and  $K = d_v/d_l$ , remains practically const. for liquids which are not associated. It shows a slight max. at the point  $T/T_c = 0.60$  to  $0.65$  and a slight min. at the point  $T/T_c = 0.85$  to  $0.90$ . In associated liquids, the value of  $B$  increases continually with the temp. and shows no max. or min.

J. C. S.

**Atomic heat of simple substances.** EDM. VAN AUBEL. *Bull. sci. acad. roy. Belg.* 7, 155-9(1921).—The validity of certain conclusions drawn by Michaud (C. A. 13, 196) is discussed, use being made of existing data for the sp. heats, etc., of Si, B, rhombic S, Ti, Mg, and Cr. Michaud's conclusions are shown to be untenable.

J. C. S.

**The relation of the critical constants and the true specific heat of ferromagnetic substances.** J. R. ASHWORTH. *Nature* 111, 773-4(1923).—The crit. field of a ferromagnetic substance is calcd. as  $\theta/8I_0$  where  $\theta$  is the magnetic crit. temp. on the abs. scale, and  $I_0$  is the max. intensity of magnetization. When this is multiplied by the true sp. heat,  $c$ , at the crit. temp. the following nos. are obtained: for Fe, 0.0225; for Co, 0.0230; for Ni, 0.0225; for  $\text{Fe}_3\text{O}_4$ ,  $3 \times 0.0230$ . The value of  $\theta/I_0$  for all these substances is thus 0.18. This is nearly equal to 5 times the energy per unit of temp. for one degree of freedom calcd. from the gas const.  $R$  and the at. wts. of the ferromagnetic metals. This fact is considered to support the conclusion, already reached by A. from other grounds, that there is an acquisition of 2 degrees of freedom at the magnetic crit. point, perhaps consisting in a conversion of translational into rotational motion of the elementary magnets.

ROBERT B. SOSMAN

**Isotherms of diatomic substances and their binary mixtures.** XX. Critical curve of oxygen-nitrogen mixtures, critical phenomena and some isotherms of two mixtures, with 50% and 75% by volume of oxygen in the neighborhood of the critical point. J. P. KURNEN, T. VERSCHOYLE AND A. TH. VAN URK. *Proc. Acad. Sci. Amsterdam* 26, 49-64(1923).—The app. was that previously used in the Leiden lab. The data on the 2 mixts. along with those for the pure gases and for air gave enough information to construct the entire crit. curve, which proved to be a straight line joining the values for the pure gases. The constns. found for the 2 mixts. were: 50%; plait-point,  $p = 41.9$  atms.,  $t = -132.66^\circ$ ; crit. point,  $p = 41.9$  atms.,  $t = 132.53^\circ$ . 75%; plait-point,  $p = 45.89$  atms.,  $t = -125.60^\circ$ ; crit. point,  $p = 45.86$  atms.,  $t = -125.53^\circ$ . The phenomenon of retrograde condensation occurs with both mixts.

E. D. WILLIAMSON

**Note on the theory of the specific heat of liquids.** F. A. LINDEMANN. *Phil. Mag.* 45, 1119-20(1923).—L. raises several objections to the theory recently advanced by Honda (C. A. 17, 1367). Atoms cannot rotate about their centers of gravity as the moments of inertia are much too small. Moreover if at. rotation occurs in liquids it must occur in gases and the at. heat of Hg vapor should be  $3R$  and the ratio of  $C_p/C_v$  1.333 instead of 1.667. Again the work done against cohesion on expansion is not negligible but amounts to at least  $1/2$  the latent heat. The atoms can execute free paths without constraint only if they are far apart. The currently accepted theory of the sp. heat of liquids is briefly restated by L.

S. C. L.

**Thermodynamics at the lowest temperatures.** R. PLANCK. *Z. Physik.* 14, 150-68 (1923).—The lower limit of the v. p. curve, the limiting value of the heat of vaporization at zero abs. and the general state of gases and vapors at low temps. are discussed by considering the extrapolation of various empirical formulas, of which a comprehensive collection is used.

E. D. WILLIAMSON

**Electromotive force measurements with a saturated potassium chloride bridge or with concentration cells with a liquid junction.** GEORGE SCATCHARD. *J. Am. Chem. Soc.* 45, 1716-23(1923).—The exptl. results indicate that the liquid-junction potential with satd. KCl is not more than 1 milliv. for solns. less than 0.1  $M$ , but that it increases rapidly with the concn. for HCl. The proof of Fales and Vosburgh that the satd. KCl bridge eliminates liquid-junction potentials depends on the assumption that in a HCl soln. the activities of the 2 ions are equal.

H. JERMAIN CREIGHTON

**Faraday's law and the action of the electrical discharge on gases.** A. DE HEMPTINNE. *Bull. acad. roy. Belg.* 5, 521-7(1919).—Faraday's law has been shown to hold, with fair approximation, for chem. effects produced by an elec. discharge in gases at low pressures.

J. C. S.

**Faraday's law and the chemical action of the electrical discharge.** A. DE HEMPTINNE. *Bull. acad. roy. Belg.* 5, 161-77(1919).—An investigation of the reduction of unsatd. oils by H, under the influence of an elec. discharge, the amt. of reduction being followed by the change in I no. of the oil. A large no. of expts., involving variations in thickness of dielectric, d. of current, potential difference, etc., are described, and do not lend themselves to abbreviated description. H. concludes that Faraday's laws of electrolysis are obeyed, at any rate, roughly.

J. C. S.

**Faraday's law and the action of the electrical discharge on metallic oxides.** II. III. IV. V. A. DE HEMPTINNE. *Bull. acad. roy. Belg.* 5, 249-60(1919); 7, 146-55, 458-68, 590-5(1921).—II. A study of the reduction of metallic oxides by H in

presence of an elec. discharge. The results fall in line with those previously obtained with unsatd. oils (cf. preceding abstr.).  $\text{PbO}_2$  is taken as a standard substance for reduction, and a large no. of other metallic oxides and also chlorides and miscellaneous substances are compared with it. CO was found to be roughly as effective in reduction as H, the expts. being carried out at low pressures to avoid polymerization, etc., of the monoxide. III. The reduction of various substances by this method shows that, as a rule, it is unimportant whether the substance in question is in contact with the positive or with the negative electrode. Values are found for the ratio  $N/N'$ , where  $N$  is the no. of H mols. disappearing during a reduction and  $N'$  the no. of ions and electrons (calcd. from the measured current). This ratio has a value ranging from zero in the case of difficultly reduced oxides such as Zn or Mg to above unity in the case of  $\text{PbO}_2$  and  $\text{MnO}_2$ , etc., the reducibility of an oxide being connected with the electrolytic potential of the corresponding metal.  $\text{KClO}_4$  is almost unaffected under conditions sufficing for the reduction of most oxides, a fact which is attributed to the purely elec. nature of the process, no thermal effect being produced by the incidence of positive ions or electrons. Thus, in the case of oxides, the amt. of reduction is approximately proportional to the amt. of current passing. IV. The reduction of  $\text{PbO}_2$ ,  $\text{CuO}$ , and ferrosulfuric oxide is effected in a dried atm. of H by means of an elec. discharge, the oxide in question being placed in contact with one of the electrodes. By measuring the variation of pressure, of potential difference between the electrodes, and the current flowing, a relation is found between the no. ( $N$ ) of H mols. used in the reduction and the no. of positive ions ( $N_i$ ) and electrons ( $N_e$ ). The point is raised as to whether in ionization the H mol. loses 1 or 2 electrons. Activated hydrogen ( $\text{H}_a$ ) offers another explanation, but the mechanism of the reduction remains in doubt. With  $\text{PbO}_2$  in contact with the positive electrode,  $N/N_i$  has values from 0 to 1.1, and when in contact with the negative electrode, values of 2.7 to 1.4 for  $N/N_e$  are obtained. Similar results are obtained for other oxides. If the positive ions are formed by the loss of 1 electron from each H mol., and if each electron liberates 1 atom of O, which then combines with 1 mol. of H,  $N/N_i$  and  $N/N_e$  should be equal to unity. Values (for these ratios) of 0.5 will correspond with the loss of 2 electrons when H is ionized and so on. V. In the earlier sections the loss of wt. of oxides when submitted to the action of an elec. discharge in presence of H was not detd. It is now found that, in the reduction of  $\text{PbO}_2$ , the wt. of H absorbed (as measured by the diminution in pressure) is equiv. to the loss in wt. of oxide, whether the latter is in contact with the positive or with the negative electrode. The oxide formed as a result of the reduction is probably Pb suboxide. When N is substituted for H in these expts., no change is observed in either gas or solid, except such as could be accounted for owing to defects in the app. CO, under similar conditions, causes the  $\text{PbO}_2$  to gain in wt., probably owing to the formation of a deposit of a lower oxide of C. J. C. S.

The formation of a reducing substance at the cathode during the electrolysis of acid and alkaline solutions. G. TAMMANN. *Z. anorg. allgem. Chem.* 126, 176-8 (1923).—About 500 cc. 0.03 *M*  $\text{H}_2\text{SO}_4$  soln. were electrolyzed 3-4 hrs., at 70 v., 2 amp., and with a Pt anode, and a water-cooled Pb cathode of 40 sq. cm. surface. The cathode was surrounded by a wide glass tube with open ends. When 200 cc. of soln. from the cathode compartment were treated with  $\text{AgNO}_3$ , then made alk. with NaOH, boiled, and the resulting ppt. was treated with  $\text{NH}_4\text{OH}$ , there remained an insol. residue of 2-4 mg. of reduced Ag. The identity of the reducing substance formed at the cathode was not detd. It was shown to be neither  $\text{Fe}^{++}$ , nor  $\text{H}_2$  or other volatile gas. The substance is unstable,  $1/2$  of it decomposing in  $1/2$  day. It can be extd. from an alk. soln. by benzene, and from the benzene by HCl. Electrolysis of dil. NaOH and KOH solns. gave similar results, although com. KOH and NaOH may contain substances which reduce small amts. of Ag ion. R. H. LOMBARD

Electrolysis of zinc oxide and cadmium oxide fused in caustic soda. R. SALANI. *Gazz. chim. ital.* 53, 229-33 (1923).—Rolla and Salani detd. the minimum decompn. voltage of the Cd ion in mixts. of ZnO and CdO fused in NaOH (*C. A.* 17, 1746). It remains to det. whether Cd and Zn can be removed separately from such mixts. by electrolysis (cf. Lorenz, *Z. anorg. allgem. Chem.* 10, 78 (1895)). 150 g. NaOH + 5 g. CdO + 5 g. ZnO were fused in an iron crucible, which served as anode. A piece of sheet iron  $2 \times 4$  cm. was used as cathode. The Cd in the deposits was detd. electrolytically and the Zn by Gallitti's method. Results at 0.5 amps. and  $440^\circ$  for 200 mins. are given. When 10 successive fractions were electrolyzed out in this way there was no satisfactory sepn. In another series of 8 expts. in which the amps. increased from 0.5 to 8.0 and the voltage from 3.7 to 7.4 and which were electrolyzed for 100 amp.-min. at  $440^\circ$ , the quantity of Cd sepg. increases with increase of the current density. Conversely

the amt. of Zn deposited decreases with the increase of current density. The easy oxidizability of the Zn gives rise to secondary effects that are manifested by a spongy deposit. By electrolyzing the same mixt. with the cathode in the upper part of the bath a deposit of 99% Cd, 0.6% Zn and 0.4% Fe was obtained. E. J. W.

**Space-filling and refractive index.** RICHARD LORENZ AND W. HERZ. *Z. anorg. allgem. Chem.* 127, 205-8 (1923).—The space-filling no. is equal to the expression  $(n^2 - 1)/(n^2 + 2)$  where  $n$  is the refractive index. The values found at zero abs. and at the b. p. by this formula are generally lower than the theoretical values of 0.467 and 0.331 resp. E. D. WILLIAMSON

**Conductivity of flames.** HJ. V. BROTHERRUS. *Ann. acad. sci. Fennicae* 16A, No. 6, 24 pp. (1921); cf. Lenard, *C. A.* 7, 1836, 3894; 9, 2174; Schmidt, *C. A.* 5, 233; 6, 176; 7, 3702.—The elec. cond. of flames contg. salts of the alkali and alkaline earth metals was detd. at temps. ranging from about 900° to 1670°. The cond. increases with the temp. and the increase is accelerated as the temp. rises. The exptl. results are shown in tables, by charts and by the deduction of mathematical equations. The findings are discussed in their relations to at. wts., at. vols. and various at. phenomena. L. W. RIGGS

**Dielectric constants and space-filling.** RICHARD LORENZ AND W. HERZ. *Z. anorg. allgem. Chem.* 127, 369-71.—The space-filling no. is obtained from the expression  $(D-1)/(D+2)$ , where  $D$  is the dielec. const. (Cf. preceding abstract.) E. D. WILLIAMSON

**Color designation.** E. G. LUDWIG. *Farben-Zig.* 28, 1257-60, 1323-5 (1923).—The Ostwald system of color designation is inadequate for practical purposes, even though it may suffice as a basis for pure physical-optical color designations. F. A. WERTZ

**Colorimetric researches. IX.** OTTO MEISSNER. *Physik. Z.* 24, 213-5 (1923); cf. *C. A.* 16, 1176.—A discussion of Ostwald's "color triangle." A. E. STEARN

**Preparing color standards.** A. P. HARRISON. *Science* 57, 716-7 (1923).—In prep. a set of comparison tubes for standards in colorimetry a change in color to the unaided eye is less noticeable between deep colors than the same change between dild. colors. This involves a geometric relationship (cf. *J. Optical Soc. Am.* 7, 375 (1923)). Having a colored soln. that matches the heaviest shade of the substance to be estd., an aliquot part of this is dild. with an equal vol. of water, part of this is dild. again and so on till there is but a perceptible difference in shade between the last two dilns. The no. of tubes required for the series may then be calcd. and the factor for the set may be found by a formula. It is suggested that color standards may be more easily and reliably prepd. by this method than by matching or dilg. by the unaided eye. L. W. RIGGS

Permalloy, an alloy of remarkable magnetic properties (ARNOLD, ELMEN) 9.

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### 3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

- International table of radioactive elements and their principal constants (1923).** *Bull. soc. chim.* 33, 679-86(1923). E. J. C.
- Explanation of the theory of the rotation of the atomic nucleus.** II. H. HENSTOCK. *Chem. News* 126, 321-5, 337-40(1923).—Application of H's. theory (cf. C. A. 17, 2669), to structure of hydrides, halides and hydroxides, with especial emphasis on B, N, and P compds. R. S. MULLIKEN
- International table of isotopes.** *Bull. soc. chim.* 33, 675-8(1923). E. J. C.
- Isotopes.** E. H. BUCHNER. *Chem. Weekblad* 20, 314-9(1923). R. BRUNNER
- The isotopes of germanium.** F. W. ASTON. *Nature* 111, 771(1923).—The mass lines indicate 3 isotopes at 70, 72, 74, with intensities in the approx. proportion 2:4:5, which agrees fairly well with the value 72.5 for the chem. at. wt. These values conform to the general rule connecting even at. no. with even at. wt.  $\text{Ge}^{70}$  is isobaric with the weakest and heaviest component of Zn, and  $\text{Ge}^{74}$  isobaric with the weakest and lightest isotope of Se. G. L. CLARK
- The separation of isotopes. Application of systematic fractionation to mercury in a high-speed evaporation-diffusion apparatus.** R. S. MULLIKEN. *J. Am. Chem. Soc.* 45, 1592-1604(1923).—M. describes a rapid app. for sepn. of the isotopes of Hg by diffusion of the vapor through a filter-paper tube at low pressure. Two 300-g. samples differing by 0.102 units of at. wt. were obtained in preliminary operation. Systematic fractionation in general is discussed. It is shown that the time required under optimum conditions is proportional to the cube of the max. at. wt. difference secured. On this basis a criterion is suggested for the value of a partial sepn. between two isotopic samples. Cf. C. A. 17, 21. R. S. MULLIKEN
- Atomic projectiles and their properties.** IV. ERNEST RUTHERFORD. *Electrician* 91, 60-1(1923); cf. C. A. 14, 3015.—An address. C. G. F.
- Relative determination of the atomic weight of chlorine in Balruze apatite.** MARGOT DORENFELDT. *J. Am. Chem. Soc.* 45, 1577-9(1923).—The Cl isotopes in Balruze apatite occur in the same proportion as in ordinary NaCl. H. JERMAIN CREIGHTON
- Uniqueness of hydrogen.** T. M. LOWRY. *Chem. and Ind.* 42, 43-7(1923).—Reviewing the work of Fry, Lewis, Faraday, Langmuir and others, L. suggests that H differs from other elements in that it is hard to det. whether an attaching bond is a covalency or an electrovalency. In the case of crystals, ions held together by the latter cause close packed crystals, open structures of low densities being due to mols. held by covalencies; an example of this is ice. The H ion has mobility while the H radical is attached to a particular atom in a particular region in the structure of the atom. The relationship of the mobile H atom of glutacnic acid to the 2 negatively charged -CH- groups is similar to that existing between the acidic H of carboxylic

acid and the 2 negatively charged O atoms of the carboxyl group. A base is called an acceptor of H nuclei. Thus in the case of strong acids acidity cannot be developed without the addn. of  $H_2O$ . A base acceptor aids the migration of H nucleus in nitro-camphor and the 2 Et acetoacetates.

P. D. V. MANNING

**Radioactive transformations. A contribution to the quantum theory of the radioactive disintegrations.** S. ROSSELAND. *Z. Physik* 14, 173-81(1923).—A theoretical paper attempting to give an explanation of radioactive disintegration. Two kinds of activated atoms are postulated on the basis of the ordinary quantum theory. In the usual case the activation consists in the displacement of an electron to one of the outer Bohr orbits, or to an orbit other than its normal one. The second type of activation consists of a non-radiating type in which an electron acquires, or possesses, an energy in its orbit which would permit it to escape from the atom, an event which can occur at any time. This type of activation he admits would be very improbable in the case of electrons emitting ordinary light waves. In the case of X-rays and  $\gamma$ -rays it is possible for such states to exist. Evidence for their existence is claimed on the basis of the work of Ellis and others. Assuming this R. states that as the electron is eventually emitted from the atom it may spiral out (owing to the conditions imposed by relativity), and in case it came from the nucleus it would give a continuous spectrum of  $\gamma$ -rays, whose limit is detd. by the max. energy of the electron. Thus the  $\beta$ -rays as well as the  $\gamma$ -rays escaping would give a continuous spectrum together with the line spectrum, which is due to electrons that come out without radiating. In order to make such a picture apply to radioactive transformations a calcul. must be made to show first that the  $\beta$ -rays may radiate energy in this fashion while the  $\alpha$ -particles which give a pure line spectrum may not do so, and second that the probability of a primary ray's losing all its energy in spiraling out is not so great but that an appreciable no. can come out with their initial energy and so cause the  $\beta$ -ray line spectra. This is done by use of the classical electrodynamics, the limiting frequency of the radiation emitted being detd. in these considerations by the energy of the electron. It is shown that in the case of the  $\alpha$ -particles, owing to their small velocity, there is continuous radiation. In the case of the  $\beta$ -ray spectra it is found that the energy which could be radiated in such a process would be sufficient to give the observed results, but the calcul. does not show that such a radiation must inevitably follow. Since it is entirely compatible with the quantum theory to postulate that the time in which an atom will stay activated before it emits the electron is completely independent of the time which it has so remained in the past, the actual radioactive decay is not in contradiction with the above theory.

L. B. LOEB

**A projection electroscope for measurements in radioactivity.** H. M. ELSLEY. *J. Optical Soc. Am.* 7, 385-7(1923).—Two satisfactory designs are given of an electroscope which is similar to existing types but differs in that it may readily be inserted in place of the slide carrier of an ordinary projection lantern.

D. E. S.

**Adsorption of the B and C members of the radium and thorium series by ferric hydroxide.** J. A. CRANSTON AND ROBERT HUTTON. *J. Chem. Soc.* 123, 1318-24 (1923); cf. *C. A.* 16, 1042; 17, 923.—Previous work on the adsorption of —B and —C members of the Ra and Th series by  $Fe(OH)_3$  has been continued. Under similar conditions, the ratio of Th B/Th C adsorbed by  $Fe(OH)_3$  is greater than the ratio of their isotopes Ra B/Ra C, even when the initial different relative concns. of the solns. are taken into account. The interval of time between prep. the solns. and the carrying out of the adsorptions has been found to be an important factor in detg. the ratio adsorbed. The influence of this time factor is in quant. agreement with that expected from the theory put forward to explain the greater proportion of the —C member adsorbed with the lapse of time.

JAMES M. BELL

**Investigations on the constant of polonium.** MILLE ST. MARACINEANU. *Compt. rend.* 176, 1879-81(1923).—The period,  $T$ , of Po, deduced from curves obtained by plotting time against the log of the current, is given as 139.5 yrs. Low results are explained by the penetration of the Po into the material used to hold it. For accurate work on the periods of radioactive substances, it is recommended that one deposit the substance on glass instead of metal, and avoid heat and the use of large quantities.

MARIE FARNSWORTH

**The relations between the radioactivity, the temperature and the sulfuration of the springs of Bagnères-de-Luchon. Explanatory hypothesis.** ADOLPHE LEPAPE. *Compt. rend.* 176, 1908-10(1923).—The springs emerging from schists are more radioactive than those from granite. In general, the radioactivity varies inversely with the temp. and the sulfuration but in a few cases it varies directly with the sulfuration. There are two types of water: the deep water, hot, with high sulfuration and little

radioactivity and the surface water, cold, not sulfurated, but radioactive. The nature of the spring waters is detd. by how much these two types are able to mix.

MARIE FARNSWORTH

The relations between the radioactivity of radium and the activity of the solar radiations. ALBERT NODON. *Compt. rend.* 176, 1705-7 (1923).—Radioactivity, measured by its photographic and elec. effects, is influenced by the radiations emitted directly by the sun and the upper atm. The influence is greater when the sun is high above the horizon but there are many variations without apparent cause. The absorbing power of various substances in regard to these radiations seems to be of the same order as with  $\gamma$ -rays.

MARIE FARNSWORTH

The radioactivity of the springs of some stations of the Pyrenees (Bagnères-de-Luchon, Vermet, the Escaldes, Thuès) and of the Central Plateau (the Bourboule, Royat, Saint-Nectaire, Sail-les-Bains). ADOLPHE LÉPAPE. *Compt. rend.* 176, 1702-5 (1923).—L. examines the radioactivity of the springs and the air above them. From his results and results obtained before by various investigators, he constructs a table showing Ra Em per l. of  $H_2O$  in the more active mineral waters of France. M. F.

The quantitative measurement of radium emanation by  $\alpha$ -rays. Corrections for pressure and the nature of the gas. ADOLPHE LÉPAPE. *Compt. rend.* 176, 1613-6 (1923).—The relation  $I_p/I_0$ , where  $I_0$  is the satn. current at a pressure of 760 mm., is independent of the quantity of emanation. It increases up to a pressure of 760 mm. but remains const. between 760 and 800 mm. The correction is negligible at pressures greater than 720 mm.  $CO_2$  has a considerable influence on the ionization current owing to the fact that it is more difficult to obtain satn. The corrections vary with the individual vessels; the smaller the vessel, the larger the correction. M. F.

Concerning the scattering of  $\beta$ -rays. W. BOTHE. *Z. Physik* 13, 368-77 (1923).—Single and multiple scattering of  $\beta$ -rays are discussed. The influence of the thickness and chem. nature of the absorbing screen, and of the velocity of the  $\beta$ -rays is considered. The scattering of  $\beta$ -rays from Ra Em was measured by a photographic method. Passage through  $80 \mu$  of Au gave a scattering 3 times greater than that expected on the basis of single scattering. The intensity decreased with an increasing angle of deviation more rapidly than corresponds to Rutherford's theory. The results with Al foil  $3.2 \mu$  thick were in approx. agreement with the theoretical values. Results with multiple scattering were in agreement with the classical theory, but measurements on single scattering showed deviations. The deviations are in qual. agreement with the quantum absorption of the electron. FARRINGTON DANIELS

Very soft X-rays. The M series for iron. G. K. ROLLEFSON. *Science* 57, 562-3 (1923).—Preliminary results on the study of characteristic radiations emitted by Fe under bombardment by electrons of energy 40-185 v., the radiation being detected photoelectrically.

R. S. MULLIKEN

True optical resonance with X-rays. GUSTAV MIE. *Z. Physik* 15, 56-7 (1923).—Preliminary expts. were made to demonstrate the existence of true optical resonance, as distinguished from fluorescence, in X-rays. Selective reflection of 3 narrow regions was near the strongest L lines in Bi and Pb (sulfide), and of 2 strips near  $K_\alpha$  and  $K_\beta$  in Zn. These are not sharp lines as in fluorescence, but correspond to a not quite sharp resonance.

R. S. MULLIKEN

An apparent reflection of X-rays at the surface of substances. F. WOLFFERS. *Compt. rend.* 176, 1385-7 (1923).—The apparent contour of every sufficiently dense object, projected by X-rays on a photographic plate, is found to be bordered by a white line and outside that a narrow black band. The intensity of the latter increases with the at. wt., and decreases with the wave length. In several ways this band behaves as if due to reflection at grazing incidence, and cannot be due to ordinary fluorescence, corpuscular rays, or scattered X-rays. The width of the band depends, however, on the distance and orientation of the anticathode from which the X-rays come. For these and other reasons reflection is an inadequate explanation, and further expts. are being made.

R. S. MULLIKEN

Deflection of X-rays by crystals. W. L. BRAGG. *Z. physik. Chem.* 104, 337-48 (1923).—Nobel lecture.

H. JERMAIN CREIGHTON

The characteristic X-rays of the first elements. J. HOLTMARK. *Physik. Z.* 24, 225-30 (1923).—In a previous paper H. detd. the K-series wave lengths of C and B (C. A. 16, 3436). When the photoelec. charge was plotted against impressed voltage, curves were obtained showing sharp changes in slope at the K-series limit voltage, from which the frequency was calcd. by the expression  $eV = h\nu$ . The value for C was in close agreement with that obtained from extrapolation of the  $K_\alpha$  frequency curve for elements of higher at. no., but the observed crit. voltage for B was 50 v. lower than

the calcd. value, as later verified by Hughes. In the present paper Li and Be are investigated to det. whether the discrepancy is characteristic only of B. For special reasons  $\text{Li}_2\text{O}$  and  $\text{BeF}_2$  were used as anticathodes. The "nicks" in the photoelec.-voltage curve are at 52.6 v. for Li and 95 v. for B.  $\sqrt{V}$  is plotted against the at. no. a straight line passing through the origin approx. connects elements nos. 2-5 at values only about  $3/4$  of those obtained by direct extrapolation the line for higher at. nos. Hughes' value for C (215 v.) also lies on this line, though the values of Richardson and Bazzoni, Kurth, and Holtsmark (286-9 v.) lie on the higher extrapolated line. This indicates that He, singly positively charged Li, doubly charged Be, triply charged B (metallic B was used in the expt. but was probably superficially oxidized), and C with 4 positive charges (as might be true by superficial oxidation in Hughes' expts.), have no 2-quantum orbit and are directly related with respect to K-series frequencies by the close similarity in the one-quantum orbit. The higher value for C corresponds to the atom with 4 negative charges, or the condition in which there are 8 electrons in the 2-quantum orbit. Thus the vapor of metallic Li should give a different K-series limit than the same element in  $\text{Li}_2\text{O}$ , just as Lind has found different values for Cl and S, depending upon the valence, or state of ionization. All atoms with configurations similar to Ne in which the 2-quantum shell is completed must be characterized by a difference between the K absorption limit and the  $K\alpha$  emission, inasmuch as it is necessary to remove the 1-quantum ring electron to a higher orbit than the 2-quantum.

G. L. CLARK

**A quantum theory of the scattering of X-rays by light elements.** A. H. COMPTON. *Phys. Rev.* 21, 483-502 (1923).—When an X-ray quantum is scattered it spends all of its energy and momentum upon some particular electron, which in turn scatters the ray in some definite direction. The change in momentum of the X-ray quantum due to the change in its direction of propagation results in the recoil of the scattering electron. The energy in the scattered quantum is thus less than the energy in the primary quantum by the kinetic energy of recoil of the scattering electron. The corresponding increase in the wave length of the scattered beam is  $\lambda_0 - \lambda = (2h/mc)\sin^2 \frac{1}{2}\theta$ ,  $\theta = 0.0484 \sin^2 \frac{1}{2}\theta$ , where  $h$  is the Planck const.,  $m$  the mass of the scattering electron,  $c$  the velocity of light, and  $\theta$  the angle between the incident and scattered ray. Hence the increase is independent of the wave length. The distribution of the scattered radiation is coned, in the forward direction according to a definite law. The total energy removed from the primary beam comes out less than that given by the classical Thomson theory in the ratio  $1/(1 + 2\alpha)$ , where  $\alpha = h/mc\lambda_0 = 0.0242/\lambda_0$ . Of this energy a fraction  $(1 + \alpha)/(1 + 2\alpha)$  reappears as scattered radiation, while the remainder is truly absorbed and transformed into kinetic energy of recoil. Hence, if  $\sigma_0$  is the scattering absorption coeff. according to the classical theory, the coeff. according to this theory is  $\sigma = \sigma_0/(1 + 2\alpha) = \sigma_s + \sigma_a$ , where  $\sigma_s$  is the true scattering coeff.  $[(1 + \alpha)\sigma/(1 + 2\alpha)^2]$ , and  $\sigma_a$  is the coeff. of absorption due to scattering  $[\alpha\sigma/(1 + 2\alpha)^2]$ . Exptl. results are given which show that for graphite and the Mo-K radiation the scattered radiation is longer than the primary, the observed difference  $(\lambda_s/2 - \lambda_0 = 0.022)$  being close to the computed value, 0.024. In the case of scattered  $\gamma$ -rays, the wave length has been found to vary with  $\theta$  in agreement with the theory, increasing from 0.022 (primary) to 0.068 ( $\theta = 135^\circ$ ). Also the velocity of secondary  $\beta$ -rays excited in the light elements by  $\gamma$ -rays agrees with the suggestion that they are recoil electrons. As for the predicted variation of absorption with  $\lambda$ , Hewlett's (C. A. 15, 2245) results for C for wave lengths below 0.5 Å. are in excellent agreement with this theory. Hence agreement between theory and expt. indicates that scattering is a quantum phenomenon. Restriction to the light elements is due to the assumption that the constraining forces acting on the scattering electrons are negligible.

G. L. CLARK

**Electronic structures of the spinels.** M. L. HUGGINS. *Phys. Rev.* 21, 509-16 (1923).—The most probable arrangement of valence electrons is that in which there is a pair on or near each center line between adjacent atoms. The valence shell of each O and bivalent metal atom is a tetrahedron of electron pairs; that of each trivalent metal atom is an octahedron of pairs. The distances between adjacent at. centers are calcd. from the d's and the positions of the O centers detd. in the crystals  $\text{ZnAl}_2\text{O}_4$ ,  $\text{ZnCr}_2\text{O}_4$ ,  $\text{ZnFe}_2\text{O}_4$ , and similar Mg, Mn, Cd and Fe spinels, by means of the assumptions that the Zn-O distance in the first 3 equals that in  $\text{ZnO}$  and that corresponding interat. distances in different spinels are equal. The d. of  $\text{MgFe}_2\text{O}_4$  is 4.47, that of  $\text{MnFe}_2\text{O}_4$  4.90 upon the above assumptions. The at. radii of bivalent Zn, Fe, Mg, Mn and Cd and of trivalent Al, Cr and Fe are computed, with the assumption that the radius of O is 0.65 Å. The association of ferromagnetism with a particular distribution of electrons, such

as the concn. of triplets in the same end of the kernel of each trivalent Fe atom, is suggested. G. L. CLARK

**The work of H. Kulenkampff. The continuous Röntgen spectrum.** A. MARCH. *Ann. Physik* 71, 603-6(1923).—The expts. by Kulenkampff (*C. A.* 17, 1752) which were thought to contradict the theory of continuous X-ray spectra by March (*C. A.* 16, 2072) are here shown to be in complete agreement with this theory. W. F. MEGGERS

**Hafnium and New Zealand sand.** ALEXANDER SCOTT. *Nature* 111, 598.—Coster and Hevesy found S.'s "new oxide" specimens to consist mainly of Fe and Ti; no Hf and no other new elements. Replacement of part of the Ti by Si gives the "new oxide" its extraordinarily refractory character. C. and H. have found that the *at. wt. of Hf* lies between 179 and 181. NORRIS F. HALL

**L series of hafnium.** AUGUST ZÁČEK. *Z. Physik* 15, 31-2(1923).—Precision measurements made at Lund. The  $\lambda$ 's are:  $\alpha_1$  1566.14,  $\alpha_2$  1576.70,  $\beta_1$  1370.17,  $\beta_2$  1349.1,  $\beta_3$  1323.6. NORRIS F. HALL

**The element hafnium.** D. COSTER. *Physica* 3, 133-41(1923).—Polemical. Statements are essentially the same as given in papers covered by *C. A.* 17, 1751, 1921, 1922. The *at. wt.* of the purest sample of Hf so far obtained was 174. Since this sample probably contained about 6% of Zr the actual *at. wt. of Hf* is about 180. C. C. VAN VOORHIS

**Diffraction of Röntgen rays in liquids. II.** W. H. KERSOM AND J. DE SMEDT. *Proc. Acad. Sci. Amsterdam* 26, 112-5(1923).—The app. used has been described previously. Expts. were carried out on liquid O, A, N, H<sub>2</sub>O, and CS<sub>2</sub>. Diffraction rings were obtained in all cases. Except for the last the results were consistent with the idea that the rings are due to neighboring mols. which may be considered as closely packed spheres. Previous evidence supports this view (*C. A.* 16, 4135). E. D. W.

**A photoelectric method for testing the Wien-Planck radiation law in the region of ultra-violet radiation.** EDUARD STEINKE. *Z. Physik* 11, 215-38(1922).—Expts. were carried out to test the validity of the Planck radiation law in the ultra-violet, with a K photoelec. cell in uvio glass, monochromatic filters, and a C filament as a source of light. The law held when  $\lambda = 316 \mu$ . The expts. are to be carried out with a black body source of radiation, a quartz cell and a quartz spectrograph. FARRINGTON DANIELS

**The motion of electrons in carbon monoxide.** H. B. WAHLIN. *Phys. Rev.* 21, 517-24(1923).—Previous work (cf. *C. A.* 16, 1703), in which the formation of negative CO ions was found to be extremely rare, has now been verified, by means of CO of great purity. Much higher mobilities (up to 11,800 cm./sec./v./cm., at 723 mm.) than before were obtained, indicating clearly that an electron liberated in pure CO remains free. Electron mobility as a function of field and pressure was studied, with alternating potentials with frequencies up to 340,000 cycles, and an equation obtained covering the data for CO. The results suggest (1) the mean free path of electrons in CO is independent of the field, (2) electron collisions with CO mols. are very inelastic. R. S. MULLIKEN

**A new Röntgen apparatus with high-vacuum camera.** ARTHUR SCHLIERDE AND HANS GANTZKOW. *Z. Physik* 15, 184-8(1923).—A great variety of spectrographic app. for X-rays has been described in recent years but the general difficulty of finding a suitable window material led to the construction of this new app., which eliminates the window by putting the camera directly in the high vacuum. Details of construction and dimensions of the app. are given. W. F. MEGGERS

**Röntgen spectroscopic measurements. Contribution to knowledge of Röntgen spectra.** ELIS HJALMAR. *Z. Physik* 15, 65-109(1923).—The problem of the atom is one of the most important questions of modern physics. For its solution, X-rays may be named as the primary exptl. means, and in theoretical research, Bohr's at. hypothesis is of greatest significance. A brief review of the Bohr theory and an outline of the structure of Röntgen spectra are given. A diagram of energy levels of the heavier atoms shows 1 K level, 3 L, 5 M, 7 N, 5 O and 3 P levels. The K and L spectral series have been most thoroughly investigated, and new results for the M and N lines are given. Measurements on the M spectra of Dy, Ho, Er, Yb, Lu, Ta, W, Pt, Au, Ti, Pb, Bi, Th and U are presented in tables. Similar results on the N series of Bi, Th and U follow. In many cases the stronger lines are shown to be complex. Many new lines have been found and placed in the general scheme of Röntgen spectra. They confirm the validity of the combination principle and permit calcs. of the energy of certain N, O and P levels. All measurements of X-ray wave lengths are based on the well known Bragg relation  $n\lambda = 2d \sin \varphi$  which has been suspected of failing for high orders of spectra. Deviations from Bragg's law are definitely shown to exist by precision measurements of Cu K $\alpha$ , and W L $\beta$ , in different orders up to 8 and 10, resp. With

increasing  $n$ , smaller and smaller values of  $\lambda$  are obtained. Various attempts to explain this are critically discussed. The reflection theory of Ewald (*C. A.* 13, 1556) appears to account for the observed deviations.

W. F. MCGOERS

**The mass of the electric carrier in metals.** R. C. TOLMAN, SEBASTIAN KARRER AND E. W. GUZANSKY. *Phys. Rev.* 21, 525-39 (1923).—For measuring  $m/e$ , an oscillating app. was used, consisting of a Cu cylinder attached to a brass torsion rod so that it could be oscillated about its axis with a frequency of 20 cycles per sec. Surrounding this cylinder was a coil of 60 miles of no. 38 Cu wire, which acted as the secondary of a transformer, and was connected to a vibration galvanometer through a specially constructed 3-stage amplifier. The tendency of the electrons in the oscillating Cu cylinder to lag behind because of their inertia leads to an e. m. f., the effects of which were finally measured by the deflection of the galvanometer, tuned to the frequency of the mech. oscillation. This deflection was then compared with that produced by the known e. m. f. accompanying a transverse oscillation of the cylinder across the earth's magnetic field. The av. of 86 detns. of  $m/e$  was  $5.2 \times 10^{-8}$ , but these preliminary results are not regarded as demonstrating a difference between the ratio  $m/e$  of the carrier in Cu and of an electron in free space,  $5.66 \times 10^{-8}$ .

G. L. CLARK

**A Braun tube which utilizes secondary cathode rays.** VICTOR ENGELHARDT. *Physik. Z.* 24, 238-42 (1923).—A Braun tube with hot cathode and a secondary cathode, the rays from which may be utilized for oscillograph purposes, is described in detail. The arrangement of the electrodes and the striction coils is such that 2 beams fall upon the light screen. It is experimentally established that the harder of these corresponds to the primary, and the softer to the secondary emission.

G. L. CLARK

**The photoelectric conductivity of cerussite and senarmontite.** WERNER HEINTZE. *Z. Physik* 15, 339-49 (1923).—As was predicted from their high  $ns$ , cerussite ( $\text{PbCO}_3$ ) and senarmontite ( $\text{Sb}_2\text{O}_3$ ) show photoelec. cond.; the max. for  $\text{PbCO}_3$  at  $\lambda = 280 \mu$  and for  $\text{Sb}_2\text{O}_3$  at  $\lambda = 313 \mu$ . The cond. is of the primary type, proportional to the light energy and the p. d. for all wave lengths.  $\text{Sb}_2\text{O}_3$  is opaque to shorter waves than  $313 \mu$ , to which may be attributed the drop in cond. below this value. The photoelec. cond., referred to the energy absorbed, lags considerably behind the quantum effect; a result to be predicted from the marked turbidity of the crystals used. They showed no fluorescence or phosphorescence. The cond. was zero in the dark. Overloading ("Überlastung") was reduced to a min. by making short exposures, etc.

D. C. BARDWELL

**The free path of slow electrons in gases.** R. MINKOWSKI AND H. SPONER. *Z. Physik* 15, 399-408 (1923).—Ramsauer (*C. A.* 15, 3933) and Mayer (*C. A.* 16, 1179) have shown that the free path of slow electrons in A varies anomalously. M. and S. demonstrate that the anomalous behavior is common to He, Ne, Kr, and Xe, but not to as great an extent in H<sub>2</sub> and N<sub>2</sub>. The slight effects in these two gases may be the result of the compensation of two opposing effects. Hg vapor shows slightly anomalous behavior. The behavior of A is accounted for as follows:—Owing to the great transparency of A atoms for slow electrons, the electron current is nearly as high at low voltages as it would be in vacuum. As soon as the penetrability of the atom is decreased with increasing velocity of the electrons, that is the free path is less, the space charge increases to a value comparable with that obtained for normal free path, and the current sinks rapidly. At about 11.5 v., the electrons make inelastic collisions with the A atoms, in which the electrons upon giving up energy to an A electron, lifting it quantumwise to a higher energy level, become slow electrons, which can then penetrate the A atom and the current increases abruptly. Upon increasing the field, as soon as the electrons can be accelerated sufficiently, the current drops again. This is repeated for all voltages, at which inelastic collisions take place. The gases used were between 92 and 95% pure. The max. values of current for the lowest voltages are not quantitatively exact.

D. C. BARDWELL

**Ionization by collision in glass at high field strengths.** A. GÜNTHER-SCHULZE. *Physik. Z.* 24, 212-3 (1923).—A note in which it is pointed out that Poole's results (*C. A.* 16, 375) on the sp. cond. of glass at high elec. field strengths can be brought into agreement with the same phenomenon in gases. Poole expresses his data in the form  $\log x = a + bX$ , where  $x$  is the measured cond. and  $X$  the field strength. These results may be equally well expressed by the same form as holds for gases i. e.,  $\log x = a + bX - \log X$ , if the primary free electrons are produced only at the cathode, or  $\log [x + (1/X^2)] = a + bX - 2 \log X$ , if the primary free electrons are distributed throughout the vol. of the glass. It is suggested that the latter two be tested since they require that, at const. field strengths,  $x$  increase exponentially with the thickness of the glass plate. Poole did not vary this.

A. E. STEARN

The determination of the charge on the electron from the "shot effect" in a glowing cathode tube. REINHOLD FÜRTH. *Physik. Z.* 23, 354-62(1922).—Schottky (*C. A.* 14, 3581) showed that the discontinuous emission of electrons from a glowing cathode in a vacuum tube can give rise to an oscillating current called the "shot effect." Expts. by Hartmann (*C. A.* 15, 2579) permitted a calcn. of the charge on the electron, but the value was too low, and varied with the frequency. A correction in integration (*C. A.* 16, 2635) brought the charge to its correct value for the highest frequency. Fürth shows that the change of the electron charge with the frequency is only apparent, being due to a physiol. effect. Using only the min. voltage necessary to give a sound in the telephone, and working only with frequencies which are not complicated by the natural frequency of the telephone membrane, Fürth obtains values for the charge on the electron which are independent of the frequency and which are in close agreement with the accepted value. With proper corrections, Hartmann's results agree with those of Fürth. Hartmann's expts. furnish no evidence then for the existence of a subelectron. See also Schottky (*C. A.* 15, 2579).

FARRINGTON DANIELS

The determination of electron charge from the shot effect in hot cathode tubes. R. FÜRTH. *Physik. Z.* 23, 438(1922).—A discussion of the article covered in the preceding abstract. Objection is raised to the use of a telephone, about which there is too much uncertainty.

F. O. ANDEREGG

The normal and inverse photoelectric effect of sub-microscopic particles. M. HAKE. *Z. Physik* 15, 110-20(1923).—In many instances particles of ultra-microscopic size may become negatively charged by ultra-violet light. This is contrary to the results when larger masses have been used. The ultramicroscopic particles are produced by vaporization and subsequent condensation of the given substance in the field of an Ehrenhaft condenser. Expts. carried out in air show that some of the particles charged are negatively charged and others positively. The positively charged particles are designated as photoelectrically normal. Particles negatively charged are said to exhibit an inverse photoelec. effect. Data are given to show that the air surrounding the particles is not ionized by the wave lengths used. The photoelec. effects in an atm. of  $N_2$  differ in many instances from those in air. Particles of turpentine, which are not photoelectrically active in air, exhibit an inverse effect in  $N_2$ . In  $N_2$  the metals Hg, Zn, and Cu are normal; Bi is "inverse"; Al is usually "inverse," seldom normal; Sb and Sn are normal and "inverse." It is noted that particles of Au, Ag, Hg, Cu, Bi, Se, and I which previously have been rendered positive by heat or light remain so after somewhat long exposure to the rays of a Hg lamp. Many metal particles which are negatively charged lose their charge to a considerable extent upon continued action of the light. Particles of the different dielectrics investigated did not change their negative charge upon further illumination. H. concludes that the inverse photoelec. effect can result only from the loss of positive electricity. Further expts. were conducted in atms. of  $CO_2$ ,  $H_2$ ,  $O_2$ , and A. The results indicate that the small particles are not unipolar. The dielec. substances investigated all exhibit the inverse photoelec. effect. Metal particles show inverse as well as normal effects in the different gases.

L. M. HENDERSON

Ionizing potentials of nitrogen and hydrogen. H. D. SMYTH. *Nature* 111, 810(1923).—Ions were produced with the common arrangement of a W filament, a grid, and a plate; and their wts. measured by means of positive-ray analysis. At 16.9 v. only  $N_2^+$  ions were present. At 24.1 volts  $N_2^{++}$  ions began to appear; while  $N^+$  ions did not appear until the voltage was 27.7. The transitions seem to be:  $N_2 = N_2^+ + e^-$ ;  $N_2 = N_2^{++} + 2e^-$ ; and  $N_2 = 2N^+ + 2e^-$ . At 16.5 volts the ionization of  $H_2$  is not usually accompanied by dissociation.

F. E. BROWN

Value of the Planck constant  $h$ . R. T. BIRGE. *Nature* 111, 811(1923).—Babcock has calcd. a new value for  $e/m$  from the Zeeman effect. It is  $1.761 \times 10^7$ . With this value of  $e/m$ , Planck's const.  $h$  is calcd. to be  $6.556 \pm 0.011$ . This is in close agreement with B.'s previously published value and coincides with Duane's value calcd. from the continuous X-ray spectrum.

F. E. BROWN

Strengthening of photoelectric and ionization currents by means of electron tubes. G. DU PREL. *Ann. Physik* 70, 199-224(1923).—By using amplifying tubes that have been well evacuated, not only is their efficiency increased but the proportionality range between the unamplified and amplified current is also increased. The mode of procedure in dealing with the heat currents of the tube is correspondingly simplified. With a so-called Pt-tube, an anode potential of 6 to 12 volts is sufficient. It was found possible to increase the degree of amplification of a single tube for weakest photoelectric or ionization currents at least 15 million. This means that it is possible to measure, photometrically, light intensities which lie on the threshold value of the human eye.

An excellent protection against electrical vibration of every frequency is essential to the arrangement.

**The luminous arc in mixtures of mercury vapor and other gases.** A. GÜNTHER-SCHULZE. *Z. Physik* 15, 254-72(1923).—On account of the impossibility of making large Hg vapor rectifiers vacuum-tight, the effect of foreign gases on the Hg arc was studied. The discharge is usually studied in narrow tubes, in which, although the field is nearly uniform, the walls interfere. A 34-l. bulb was here used. This eliminates wall effects, although a non-uniform field is introduced. In the space between the cathode glow and the spot of luminosity at the anode, the discharge in pure Hg vapor at low pressures is non-luminous and the corresponding p. d. is only 3.4 v. At higher pressures the p. d. rises and the luminous arc appears, extending from the anode. At 4 mm. pressure and 11 v. this reaches the cathode. Similar phenomena occur when foreign gases are present, but higher voltage drops are needed to reach any given stage (e. g., the discharge is still non-luminous in O at 60 v.). The p. d. increase with (a) the heat cond. of the gas, (b) the energy loss of an electron per collision with a mol. of foreign gas. The order of increasing p. d. is Hg, A, CO<sub>2</sub>, NH<sub>3</sub>, N<sub>2</sub>, H<sub>2</sub>, O<sub>2</sub>, SO<sub>2</sub>. At high current d. or pressure, the arc either breaks or goes over into a new form, a narrow, exceedingly luminous tube with a lower p. d. The various phenomena are found to be in agreement with theoretical considerations. Under special conditions a remarkable striated discharge is obtained, with a high p. d. Nitrogen, with graphite anodes, or oxygen, with Fe anodes, causes a conducting film to become smeared on the walls.

R. S. MULLIKEN

**The anode drop and the dependence of the gradients [in the positive column] on the current strength.** A. PARTSCH. *Z. Physik* 15, 287-306(1923).—The anode drop in Hg vapor approaches 3.72 v. at pressures above 0.4 mm. At lower pressures and small currents it has values near 10.39 and 5.74 or 5.52 v.; 2.7 v. is also reported in the literature. Each value seems to be a difference between the ionization potential (10.39 v.) and an important resonance potential. In H the anode drop is 17.6 v. (1.2 v. more than the ionization potential) at higher pressures, rising at lower pressures. In N<sub>2</sub> the value is 19 v., 2 v. more than the ionization potential. In A and Ne the anode drop approaches the lowest resonance potential with increasing current (and seems to go even lower in A), while at low current d. it is equal to the ionization potential. Measurements were made by the use of an auxiliary electrode in connection with a study of the potential gradients in the positive column of the discharge tube. The gradient (X) was found to depend on the current (i) in A and N<sub>2</sub> according to an equation of the form  $X = a + [b/(C + i)]$ . Cf. Günther-Schulze, C. A.

R. S. MULLIKEN

**Cathode drop and current-strength of glow discharge in mercury vapor.** A. GÜNTHER-SCHULZE. *Z. Physik* 15, 244-53(1923).—Expts. were made to det. the energy losses in Hg-vapor rectifiers due to reverse current. This occurs as a glow discharge when the reverse e. m. f. exceeds the normal cathode drop. The relation between glow current strength and cathode drop depends on the form and size of the discharge tube. Observations were made in a 34-l. bulb. The normal cathode drop at a gas-free Fe cathode was detd. as 533 v. in Hg vapor, 357 v. in air, and 281 v. in H. The relations of c. d. to pressure, and to applied e. m. f. above normal cathode drop, were studied in Hg vapor, air, and H. Air and H, when present as impurities in Hg vapor, had little effect on the normal cathode drop or on the c. d. at higher applied e. m. f., unless their partial pressure at least equalled that of the Hg. Cf. C. A. 17, 2388. R. S. M.

**Bräuer's theory of the function of the cathode in electric arcs.** A. TROWBRIDGE AND K. T. COMPTON. *J. Optical Soc.* 7, 321-5(1923).—Bräuer (C. A. 14, 2885) claimed to have shown that the current in the elec. arc is not maintained chiefly by the electrons liberated from the incandescent cathode as the theory of J. J. Thomson requires. This he did by cutting off the arc suddenly and observing the current carried by the electrons emitted from the hot cathode before the latter had cooled. This current (which Bräuer claimed was due to all the electrons from the cathode), dropped to a small value as soon as the arc was extinguished, whence he concluded that the electrons were too few in no. to maintain an arc. T. and C. repeated Bräuer's measurements with essentially the same arrangement, and obtained the same result. This result they point out is, however, misinterpreted by Bräuer for they show by calcn. that owing to the absence of positive ions in the arc after it has been extinguished, the electron current which Bräuer measured is not the max. possible current from the hot cathode, but only a small fraction of it, that flows in spite of the space charge effect which becomes appreciable in the absence of the positive ions. This T. and C. prove to be true by cooling the anode. If the current after extinction of the arc is due to electrons alone



cooling the anode should not alter this current. If, however, the magnitude of this current is affected by the positive ions then cooling the cathode should make the current after extinction of the arc fall to zero very rapidly, for this cooling diminishes the positive ions. This was found to be the case.

L. B. LOEB

A method for neutralizing the electron space charge by positive ionization at very low pressures. K. H. KINGDON. *Phys. Rev.* 21, 408-18(1923).—At very low pressures, viz.  $10^{-6}$  mm., the space charge produced in a no. of gases by the emission of electrons from a hot wire cathode going to an outside coaxial cylindrical anode may be neutralized by the charges on the + ions, by conserving the + ions naturally formed. The ions are conserved by preventing their escape from the ends of the cylindrical condenser formed by the filament and the anode, by making the anode a cylinder with closed ends, leaving only space enough for the filament to pass through. The theory of the motion of the ions is discussed and it is shown by a series of different exptl. measurements that the simple theory is essentially correct.

L. B. LOEB

Radiation a form of matter. A. H. COMPTON. *Science* 56, 716-7(1922).—It is advantageous to consider radiation as a form of matter. Definitions are satisfied, in that radiation occupies space, possesses inertia and affects the senses. The law of the conservation of mass remains valid if radiation is matter. The conception of an ether is superfluous for if radiation is matter it can make its own waves, as does a stream of water when the nozzle is shaken. The electromagnetic field includes positive and negative charges and radiation. Matter is continuous then and the fundamental thing in it is elec. intensity.

FARRINGTON DANIELS

The anode of the mercury arc. A. GÜNTHER-SCHULZE. *Z. Physik* 13, 378-91 (1923).—From theoretical considerations Günther-Schulze predicts the influence of various factors on the voltage drop at the anode of the Hg arc. These conclusions were verified by expts. in which the anode drop was measured with an exploration electrode and checked through detns. of the energy given to the anode. The potential gradient at a graphite anode decreased with increasing vapor pressure of Hg, falling from about 18 v. to about 4.8, and then remaining const. As long as the anode drop was above this min. value it was limited by the intensity of resonance radiation from the Hg. A concave anode favored the concn. of the resonance radiation and diminished the anode fall, while a convex anode increased it. Expts. on the influence of the electrode material were not conclusive. As long as the vapor pressure remained const. the anode drop was independent of the current strength and the temp. of the anode.

F. D.

The fine structure of high-frequency absorption limits. The L limits of xenon. A. LEPAPE AND A. DAUVILLIER. *Compt. rend.* 177, 34-7(1923).—The absorption of Xe contained at about atm. pressure in a small glass cell (4 mm. thick) covered with thin sheets of cellophane is studied in the X-ray region and 3 L limits are found. To within a few tenths of an X unit ( $10^{-11}$  cm.) the values are  $L_1 = 2272.4$ ,  $L_2 = 2425.3$ ,  $L_3 = 2587.5$  X. These values fall exactly, on the Mosely graph of levels, on the prolongation of a straight line representing the elements Ag-I, but not on the straight Cs-Nd. In the latter case there is a discontinuity for Xe. This phenomenon, due to an internal electronic rearrangement occurring for this element, must be exhibited by all the rare gases.

W. F. MEGGERS

Regularities in the screening constants of Röntgen spectra. A. SOMMERFELD. *J. Optical Soc. Am.* 7, 503-8(1923).—Two types of doublets are recognized in X-ray spectra. The relativity doublets most likely owe their origin to that part of the electron path which passes near the nucleus where relativity demands a large increase in the mass of the electron and are characterized by a screening const.  $s$ . It appears that the various  $s$  values of the M and N doublets are integral multiples of a common basic unit which lies between 4.1 and 4.4. The L doublet for which  $s = 3.50$  does not fit the rule. The screening doublets are characterized by  $\Delta s$ , the difference between two screening consts. and the various values of  $\Delta s$  are integral multiples of a basic unit 0.57 except that for the L doublet a real discrepancy again appears. The regularities both in relativity and in screening doublets are of an empirical nature and it is not possible at present to say what these regularities signify in the at. model.

W. F. MEGGERS

Light emission from excitation of atoms. FRITZ SCHRÖTER. *Z. Physik* 15, 322-38 (1923).—At low pressures, the light rays from the positive column result from the inelastic collisions of electrons, which give up their energy of motion quantumwise to atoms, thereby exciting them to light emission. Such radiation should theoretically be very efficient from the standpoint of visible radiation per energy input. A theoretical, mathematical treatment of the case for Hg and Na vapor gives high value for this efficiency compared to temp. radiation of a black body. The large dimensions of the

discharge tube necessary for high efficiency are prohibitive from the technical standpoint. The relatively high efficiencies of the Ne tube and the quartz Hg lamp are discussed.

D. C. BARDWELL.

**The luminescence of phosphors in a high electrical field.** FERDINAND SCHMIDT. *Ann. Physik* 70, 161-68 (1923).—A quant. study of the effect of high elec. fields on 10 different phosphors. The time of the glowing of a phosphor is diminished by subjecting it to an elec. field during the phosphorescence. If the elec. field is allowed to act until no phosphorescence is visible and then is removed, a very weak but persistent glowing takes place; if the direction of the field is reversed a bright luminescence is observed. The intensity of the glowing of a phosphor subjected to an elec. field after excitation increases with the strength of the field. The amt. of phosphorescence is the same whether or not an elec. field is applied during and following excitation. To explain the observations it is assumed that the phosphorescence centers of a phosphor are polarized. During the process of excitation which results in phosphorescence, electrons from the metal atoms wander to certain neighboring atoms and are there stored up. The metal atom thus becomes positive and the stored atom negative. The reverse process takes place during phosphorescence. An electric field influences this interchange of electrons.

HARRY B. WEISER

**Phosphorescence caused by active nitrogen.** E. P. LEWIS. *Nature* 111, 599-600 (1923).—Active N excites phosphorescence in a number of solid compds. such as  $\text{UO}_2$ ,  $(\text{NO}_2)_2$ ,  $\text{ZnS}$ ,  $\text{BaCl}_2$ ,  $\text{SrCl}_2$ ,  $\text{CaCl}_2$ ,  $\text{CsCl}$ ,  $\text{LiCl}$ ,  $\text{NaCl}$ ,  $\text{KCl}$ ,  $\text{NaI}$ ,  $\text{KI}$ ,  $\text{Na}_2\text{CO}_3$ , and  $\text{SrBr}_2$ , but not in  $\text{K}_2\text{SO}_4$ ,  $\text{KNO}_3$ ,  $\text{KOH}$ ,  $\text{HgBr}$ ,  $\text{CaCO}_3$ ,  $\text{CaS}$ , etc. In a number of cases the glow lasted several seconds. The color was green or bluish green and the spectra appeared continuous in all cases except with U salts, which showed characteristic bands. It seems possible that the phenomenon is due to chem. reactions with the active N or it may be due to the presence of free electrons. The after-glow depends on the presence of a trace of O or some electronegative element and is destroyed by the presence of more than a trace. It is possible that in pure N there is no appreciable after-glow because the great electron density favors rapid recombination. With an excess of O the electrons may all attach themselves to this element forming NO with the emission of Deslandres' third group of bands.

HARRY B. WEISER

**The stability of the centers of phosphorescence. I. Effect of temperature on the stability.** H. KUPPENHEIM. *Ann. Physik* 70, 81-112 (1923).—The persistence of the phosphorescence bands for Ca-Bi  $\alpha$  phosphor, 1 N and below 1 N was followed at various temps. up to a short time after the conclusion of excitation. From these data were calcd. the distribution of centers of varying duration at different temps. and conclusions were drawn concerning the effect of temp. on the behavior of the d-centers. The known shortening of the duration of all centers with rising temp. was confirmed. This is accompanied by a decrease in the no. of centers, the smaller ones disappearing first followed by the larger ones. D-centers remain in their original condition and distribution only in case an upper boundary temp. is not exceeded. The m-centers differ from the d-centers in their extraordinary stability toward heat through a wide range of temp. **II. Effect of destructive pressure on the stability.** *Ibid* 113-20.—The action of pressures that destroy phosphorescence on m- and d-centers and on d-centers of different size is exactly the same; all were destroyed in the same numerical ratio. Investigations on the destruction of the centers by pressure applied in different ways support the theory that energy-insulated empty spaces exist in the centers.

HARRY B. WEISER

**Boric acid phosphorescence.** RUDOLF TOMASCHKE. *Ann. Physik* 67, 612-47 (1922).—T. studied the phosphorescence of heated boric acid contg. small amts. of phthalic anhydride, terephthalic acid, uranine, naphthalic acid and phenanthrene. (Cf. C. A. 15, 1459; 16, 2078.) The spectrum lines, their intensity and duration were investigated. The decompn. of the org. mol. was not the cause of the luminescence. Absorption bands of the phosphorescent materials agreed with the emission spectra. With phenanthrene the phosphorescence spectrum was similar to its fluorescence spectrum in soln. It was shown from time-intensity curves that a bimol. chem. reaction was not the cause of the after-glow.

F. DANIELS

**The luminescence of decomposing ozone.** M. TRAUTZ and W. SEIDEL. *Ann. Physik* 67, 527-72 (1922).— $\text{O}_3$ , after passage through a short rubber tube, gives luminescence detectable with the eye, even at room temp. Purified  $\text{O}_3$  gives no luminescence even at  $400^\circ$ . No luminescence results, when H is added. A mixt. of purified  $\text{O}_3$  and CO emits light, however, if heated to 150 or  $200^\circ$ . The light extends from 460 to  $560 \mu$  with a max. at 500. Different mixts. of these gases were passed through a heated tube, provided with a glass window and the intensity of illumination was measured with a photoelec. cell of Rb. The column of gases was 15 cm. long. Expts. with an enclosed vol. of reacting gases were carried out also. The quantity of light emitted was nearly

proportional to the product of the initial concns. of CO and O<sub>2</sub> and independent of the presence of indifferent gases such as N<sub>2</sub> and CO<sub>2</sub>. At high temps., the quantity of light emitted approached a limiting value. The decrease of luminescence followed approx. the equation for a second-order reaction.

FARRINGTON DANIELS

**The molecular scattering of light in benzene, vapor and liquid.** K. R. RAMANATHAN. *Phys. Rev.* 21, 564-72(1923).—The intensity of sunlight scattered at right angles was detd. photometrically, relative to that scattered by liquid ether. From 35 to 283° it increased rapidly, for both vapor and liquid. The scattered light was incompletely polarized at low temps., but much more completely at high temps. The data agree well with the quant. formulation of the theory according to which part of the scattering is due to the anisotropy of the mols., this part being responsible for the incomplete polarization. Further work of this kind may give information as to the mutual influence of mols. in a liquid. In the absence of exptl. data, the isothermal compressibility of benzene vapor is calcd. by a formula derived from Dieterici's equation, corrected by a factor found applicable to other substances for which compressibility data exist.

R. S. MULLIKEN

**The spark spectrum of rubidium.** H. REINHHEIMER. *Ann. Physik* 71, 162-77 (1923).—According to the displacement law of Kossel and Sommerfeld the spark spectrum of Rb should resemble the arc spectrum of Kr, but since the structure of the latter is still unknown an attempt is made to find analogies between the spectrum of ionized Rb and that of Ne. The most favorable exptl. conditions for the production of the spark spectrum of Rb are described and the spectrum is accurately measured in the interval 3300 to 7320 Å., the wave lengths being given to 0.001 Å. for 130 lines. Accurate data in the region of shorter wave lengths are still lacking so that it is impossible to establish series in this spectrum at present. However, a qual. comparison with the Ne spectrum is readily obtained as follows. The lines of Ne may be arranged in a scheme of wave nos. such that const. differences occur between any parallel rows, and 103 of the 130 measured Rb II lines are here arranged in a similar scheme. The  $p$ -term for Ne has been found to be tenfold and 9,seps. therefore recur among the wave-no. differences. Nine const. differences are also found in the spark spectrum of Rb and this indication of the multiplicity of  $p$ -term is regarded as a qual. verification of the displacement law.

W. F. MEGGERS

**Further observations on a relation between the spectra of ionized potassium and argon.** P. ZEEMAN AND H. W. J. DIK. *Ann. Physik* 71, 199-203(1923).—In an earlier paper (cf. C. A. 16, 4140) some similarities between the K II and A I spectra were noted. A sort of correspondence is expected from the spectroscopic displacement law of Kossel and Sommerfeld, since ionized K and neutral A atoms both have 18 outer electrons. New measurements have been made in the ultra-violet spark spectrum of K but the const. differences found among the longer waves are not repeated for waves shorter than about 3000 Å. It is suggested that the second spark spectrum of K which may be analogous to the (blue) spark spectrum of A begins here.

W. F. MEGGERS

**Some regularities in the arc spectrum of lead.** K. W. MEISSNER. *Ann. Physik* 71, 135-41(1923).—Of the elements in the 4th column of the periodic system only Sn and Pb have been investigated for regularities in their spectra. Kayser and Runge in 1894 found 10 triplets with const. differences in the Pb spectrum. Additional wave-length measurements in the infra-red and in the extreme ultra-violet have made it possible to discover more regularities of this type. About 90 lines have been measured and about 50 of these are arranged in a wave no. table of 5 columns with seps. of 10807.40, 2503.78, 327.33 and 7818.92. Attention is called to other sym. groups in which a middle line of wave no.  $\nu$  is associated with two others,  $\nu + \Delta\nu$  and  $\nu - \Delta\nu$ . Nine examples of these are given but it is admitted that the uncertainty of the measurements makes it impossible to decide if the symmetry is real or accidental.

W. F. MEGGERS

**Symmetrical line-series in the iron spectrum.** A. HAGENBACH AND H. SCHUMACHER. *Ann. Physik* 71, 19-40(1923).—A photograph of the Zn arc spectrum in which Fe was present as an impurity showed a group of about 40 lines with sym. arrangement in the region 4845 to 5464 Å. Further search revealed an analogous group of 28 lines in the ultra-violet, 3000 to 3770 Å. Each group is really double and somewhat interspaced but can be represented as 4 sequences, 2 of which run left and 2 right, from the point of symmetry. In the first group most of the lines are double and the mean wave lengths are converted to wave nos. Plotting the wave nos. as ordinates and serial nos. of the lines as abscissae gives a graphical representation resembling series except that line intensities are irregular and 2 close groups converge to red while the

other 2 run toward the violet. Nothing is known of the origin of these series and only empirical tests can be made to represent them analytically. Neither the parabola nor the catenary fits the observations. A Balmer type formula gives an approx. representation when  $m$  for the first line is arbitrarily given a large value. Other types of series formula are tried also and satisfactory representation is claimed for some of them. Attempts to show by means of pressure effect or Zeeman effect that the lines of each series are really physically related are inconclusive. In a supplement, an effort is made to decide if the so-called group-spectra indicated by Gehrcke (*Ann. Physik.* 65, 640 (1921)) are exact when tested for symmetry by means of wave lengths or by wave nos. Deviations from symmetry are of the same order in both tests. (This paper contributes nothing of any significance to regularities in the Fe spectrum. Cf. following abstract. ABSTR.)

W. F. MEGGERS

**Regularities in the arc spectrum of iron.** F. M. WALTERS. *J. Wash. Acad. Sci.* 13, 243-52 (1923).—According to the Bohr theory different spectral lines result from different combinations of a multitude of possible states of energy existing for each atom. The different sets of levels are usually polyfold and intercombinations of these multiple levels give rise to groups of spectral lines which have been called multiplets. The wave-no. differences of the lines are proportional to the energy differences of the associated levels and when one multiple set of levels enters into combination with two or more different sets, the corresponding groups of lines will repeat the wave-no. differences characterizing this set of levels. Twenty multiplets each contg. from 6 to 14 lines are given in this preliminary report. These groups disclose 13 sets of polyfold levels, one set recurring in 9 of the multiplets. The max. multiplicity is 5. These repeating differences are strictly const., again showing that the Ritz combination principle is one of the most exact laws of physics. The total no. of lines here classified is 212, which includes 102 of the 134 lines described as reversed in the arc spectrum of Fe. The correlation of the multiplets with temp. classification and pressure shift proves that the lines are physically related. The same can be said of Zeeman effect when accurate data are at hand. These are, without doubt, the first significant regularities detected in the spectrum of any element in column VIII of the periodic system.

W. F. MEGGERS

**Ultra-violet absorption spectrum of glyoxal.** A. LUTHY. *Compt. rend.* 176, 1547-8 (1923).—Hexane solns. of glyoxal were studied in the spectral region 1900 Å. to 5000 Å., and the results are given in a graph. Between 4613 Å. and 3119 Å., 17 narrow bands which may be arranged in 4 series, were observed. In the ultra-violet at about 2800 Å. there is a very wide band, and another of these appears in the extreme ultra-violet, about 1950 Å.

W. F. MEGGERS

**Ultra-violet absorption spectrum of biacetyl.** G. C. LARDY. *Compt. rend.* 176, 1548-50 (1923).—Observations on hexane solns. of biacetyl show 4 bands in the region 4512 to 4054 Å., a wide band at about 2800 Å., and another band at about 1950 Å. is suspected. Comparison with the results for glyoxal (cf. preceding abstr.) indicates that substitution of CH<sub>3</sub> groups for H produces a widening of the narrow bands and a general increase in the coeff. of mol. absorption. The position of the bands is the same for these two compds. contg. 2 carbonyls in conjugate positions.

W. F. MEGGERS

**Ultra-violet absorption spectrum of *p*-quinone.** F. W. KLINGSTEDT. *Compt. rend.* 176, 1550-2 (1923).—The absorption spectrum of *p*-quinone has heretofore been studied only qualitatively and only in solvents (water, alc., ether) which modify the normal spectrum. By using the quant. method of Victor Henri hexane solns. of *p*-quinone, purified by fractional sublimation, are studied in the spectral region 2000 Å. to 5500 Å. The results are given in a graph and a table giving coeffs. of mol. absorption as a function of frequencies. In the visible and violet, the normal absorption spectrum of *p*-quinone has 14 narrow bands which may be arranged in 3 series. Two very wide bands are found in the ultra-violet at about 2790 Å. and 2410 Å.

W. F. M.

**Brightness-difference sensibility as dependent on color.** ALICE DUSCHEK-FRANKFURT. *Sitzb. Akad. Wiss., Wien., IIa Abt.* 131, 171-97 (1922).

W. F. MEGGERS

**The discontinuity K of absorption in krypton and in xenon.** M. DE BROGLIE AND A. LEPAPE. *Compt. rend.* 176, 1611-2 (1923).—All elements show at the end of their X-ray spectra on the high-frequency side, a discontinuity of absorption designated by the letter K. Detns. of the position of K were lacking for the rare gases beyond A. The absorption spectra of Kr and Xe were therefore investigated, the gases being contained in glass tubes 20 cm. long by 1 cm. diameter, closed with thin mica windows through which X radiation was passed. The K bands of absorption were found at

the places predicted by Moseley's law. The wave length for Kr is 0.8648 Å., and for Xe 0.8588 Å.

W. F. MEGGERS

**High-frequency spectrographic investigations in the rare earth group.** A. DAUVILLIER. *Compt. rend.* 176, 1381-3 (1923).—The L series of the X-ray spectra of Ba, Ce, Nd, Sm, Eu and Gd have been measured with reference to the K lines of Cu and Fe, and are given in a table of wave lengths whose values are probably correct to several tenths of an X unit ( $X = 10^{-11}$  cm.). The absorption lines  $L_1$  and  $L_2$  first discovered for Ba have been traced up to Gd. These measurements show that the N shell of electrons is 4-quantic with 10 normal levels, even before the appearance of the rare earths, and it has become such without doubt for the preceding quadrivalent element, Sn.

W. F. MEGGERS

**Colloidal supports for obtaining the emission spectra of solutions.** JACQUES ERRERA. *Compt. rend.* 176, 1874-6 (1923).—The study of emission spectra of liquids is of interest chiefly for qual. chem. analysis and to det. the spectral lines of greatest sensitiveness. The usual method is to produce a spark between a metallic electrode and the soln., which has the disadvantage of showing the spectrum of the electrode and a strongly condensed discharge is impossible. De Gramont (*Compt. rend.* 145, 1170 (1907)) conceived an arrangement in which the spark occurs between two drops of liquid emerging by capillarity from two small orifices in quartz tubes. In the method now proposed capillarity is replaced by diffusion. Gelose is highly purified, prepd. in the form of rods, soaked for several hrs. in the electrolyte to be analyzed and then held in brass clamps which are attached to the secondary of the transformer. The electrolyte diffuses to the surface and is volatilized in the spark. The spectrum of gelose itself contains the most sensitive lines of Ca, Mg, Na, Ag, Cu and certain bands due to  $H_2O$  vapor and air.

W. F. MEGGERS

**The mass of the particles which emit the secondary spectrum of hydrogen.** DUVIVIEZ. *Compt. rend.* 176, 1876-9 (1923).—Two spectra of very different structure, the Balmer series and the banded or secondary spectrum, may be emitted by H. The Balmer series is now generally attributed to the H atom and the secondary spectrum to the  $H_2$  mol. Fabry and Buisson (*C. A.* 6, 3221) deduced the mass of luminous particles from observations on the limiting order of interference  $N$ , employing the well known formula  $N = 1.22 \times 10^4 \sqrt{m/T}$ , in which  $T$  is abs. temp. and  $m$  is the at. mass. They attributed both spectra of H to the atom. Merton (*C. A.* 16, 3036) measured the widths of different spectral lines directly and his results indicate that the Balmer series is at. and the secondary spectrum is mol. Buisson and Fabry requested D. to repeat their work and accordingly about 30 lines in the orange and yellow have been examd. visually and a blue group has been studied photographically. All the lines examd. indicate that the secondary spectrum has its origin in the  $H_2$  mol. Buisson and Fabry were in error because the visibility of the interferences which they observed was diminished by various causes, chief among which, in their opinion, was the low dispersion of their spectroscope, which did not resolve the lines.

W. F. MEGGERS

**The influence of metallic surfaces on the spectra of mercury, cadmium, helium and oxygen.** L. JANICKI AND E. LAU. *Ann. Physik* 71, 562-6 (1923).—A 30-cm. spectrum tube of 1.3-cm. bore was chemically half-silvered inside and the spectra of gases and metallic vapors in such a tube were compared with their appearances in unsilvered tubes. Qual. observations indicate that the band spectra of Hg, Cd and O are produced with greater intensity in silvered than in unsilvered tubes. The metallic surface had no effect on the spectrum of He. Changes in the Ag layer were observed to take place when the discharge was passing through the tube. The metal was sputtered and redeposited on the walls of the tube and when stratification of the positive column occurred the Ag deposit also became stratified.

W. F. MEGGERS

**The intensity, widening and pressure shift of spectral lines, especially of the absorption line 2537 of mercury.** CHR. FUCHTBAUER, G. JOOS AND O. DINKELACKER. *Ann. Physik* 71, 204-27 (1923).—The addn. of foreign gases exerts upon spectral lines a variety of effects which have heretofore been known only in vague outline (cf. *C. A.* 16, 1706) and the object of this work was to obtain complete exptl. data on this subject. The observations were made with a quartz-spectrograph having 5 Cornu prisms, the absorption tube being an Fe tube of 88 mm. length and 8 mm. bore, contg. Hg vapor and various gases at pressures up to 50 atms. The continuous spectrum of a Cd spark served as a background for the absorption line. Photographic methods were used to measure intensities in the spectrum and the form of the absorption line was obtained from curves traced by the Koch registering microphotometer. The results are summarized as follows: The form (intensity curve) of a spectral line widened by foreign

gas depends on the gas itself. The 2537 Å. line of Hg gives an unsym. intensity curve with A, N<sub>2</sub>, O<sub>2</sub>, CO<sub>2</sub> and H<sub>2</sub>O vapor but is symmetrically widened by H<sub>2</sub>. The half-width of the line increases proportionally with the d. of the disturbing gas, but the widenings produced by equal nos. of mols. (unit relative density) are of the same order of magnitude for all the gases. The total absorption decreases as the d. of the disturbing gas increases, the no. of absorbing atoms remaining const. Computation gives the no. of resonators for the 2537 line of Hg as about  $1/10$  the no. of vapor atoms. The displacement of the max. of absorption toward longer waves is proportional to the gas d. in each case, but the sp. action of different gases may be different, as is shown by the following figures which give the displacement  $\Delta\lambda$  in Angström units for unit relative d. A 0.00800, H<sub>2</sub> 0.00422, N<sub>2</sub> 0.00800, O<sub>2</sub> 0.0079, CO<sub>2</sub> 0.00685, H<sub>2</sub>O 0.00500.

W. F. MCGGERS

**The spark spectra of aluminium.** I. F. PASCHEN. *Ann. Physik* 71, 142-61 (1923).—During an investigation of the enhanced spectrum of He in 1916, it was noticed that some strong new triplets occurred when the cathode cylinder of the spectrum tube was of Al metal. These were later recognized as belonging to Al II, simply ionized Al, whose spectrum of triplet and singlet series should resemble the arc spectrum of Mg, assuming the displacement law. The exptl. conditions for producing an intense Al II spectrum are described. In addn. to the spectra of Al I and Al II which occur with direct current discharge under these conditions a new spectrum, that of doubly ionized Al (Al III), is produced by condensed discharge. In the He tube with Al cathode, these spectra, especially the higher members of series, are developed with sharpness and intensity permitting exact wave-length measurements. In the present paper, data are presented for the second spark spectrum of Al III, which has been completely analyzed. The wave lengths of 56 lines (5722 to 1353 Å.) are given together with wave nos. and series designations in which the numbering follows Bohr's new ideas. In addn. to the regular series (principal, sharp, diffuse and fundamental or Bergmann) a super-Bergmann, a super-super-Bergmann series and various intercombinations of these are indicated. The series formulas contain 9 N for the Rydberg const. A comparison of spectral terms for Na I, Mg II and Al III is made. The values of the s and p terms decrease and those of d, f, f', etc., increase in the order Na I, Mg II and Al III. From these term values one can describe, according to Bohr, the position and quantum nos. of the corresponding orbits. II. *Ibid* 537-61.—About 300 lines belonging to the spectrum of singly ionized Al (Al II), obtained from a spectrum tube with cylindrical Al cathode and contg. a low pressure of He, are measured in international units. The table of wave lengths extends from 7471 to 1671 Å., and series designations are given for most of the lines. The system of triplet series (s, p, d, f and f') with 4N is established but the associated system of singlet series could not be demonstrated. The d, terms are anomalous,  $md_1$  being smaller than  $md_2$  while the reverse is true of all triplets known heretofore. The septs.  $\Delta mf$ , increase from  $m = 4$  to  $m = 7$ , thus attaining values which are unusually large for an f series, and then decrease. This is also anomalous. The term values of Al II, Mg I and H are compared in a table showing the stationary energy states associated with the 12th electron and nuclear charges of 12 (Mg I) and 13 (Al II). Here again, as in a similar comparison in Part I, the term values for s and p decrease from Mg I to Al II, showing that the orbits penetrate into the inner electron shell. The d, f and f' terms increase from Mg I to Al II and depart from the value  $N/m^2$  for H, indicating that the corresponding orbits are outside. Several triplet groups in the spectrum of Cl are also presented. The lines appear brightly in the middle of the cathode cylinder when a tube contg. a trace of Cl in an atm. of He is operated with direct current. Two 9-line multiplets arising from a triple p level and quintuple d level resemble the multiplets in Cr and Mn. From these composite triplets and other simple ones approx. term values are derived which make it appear probable that these groups belong to the spectrum of singly ionized Cl (Cl II), which should resemble the arc spectra of elements in column VI, especially S.

W. F. MCGGERS

**Band spectrum in the arc spectrum of silicon.** C. PORLEZZA. *Atti accad. Lincei* 31, ii, 513-7(1922); *Science Abstracts* 26A, 200-1.—A new band spectrum, observed in the arc spectrum of Si, exhibits analogies with the flame and spark spectra, but contains bands not found in these (cf. de Gramont and de Watteville, C. A. 2, 3192). H. G.

**Regularity in the band spectra of silicon.** C. PORLEZZA. *Gazz. chim. ital.* 53, 215-24(1923).—In a previous paper P. (preceding abstr.) described new results on the arc spectrum of Si and showed that the band spectrum observed is analogous to that obtained by burning SiCl<sub>4</sub> or by the spark passing between 2 Si electrodes (de Gramont, de Watteville, C. A. 2, 3192). P. has now found that all the chief bands that

appear in the arc spectrum of Si can be arranged in 5 series. It was also found that the chief bands observed by de G. and de W. (*l. c.*) in the flame and spark spectra of Si may be incorporated in these 5 series. The arc spectrum of Si is for the no. of bands and their intensity intermediate between that of the flame and that of the spark.

E. J. WITZEMANN

**The series spectrum of trebly ionized silicon (Si IV).** A. FOWLER. *Proc. Roy. Soc. (London)* 103A, 413-29(1923).—With the ordinary arc and spark between Si electrodes and vacuum tubes contg. chloride or fluoride of Si numerous new spectral lines have been observed and have been classified in 4 groups, in extension of the groupings made by Lockyer in connection with stellar spectra. The 4 groups represent successive stages of ionization and have been designated Si I, Si II, Si III and Si IV. The spectra consist alternately of triplets and doublets, in agreement with the displacement law of Kossel and Sommerfeld, and the series const. has the successive values of N, 4 N, 9 N and 16 N. The present paper deals chiefly with the series of Si IV, for which the new data have fully established 16 N as the series const. The spectrum is similar to that of neutral Na, (Na I) but the main series which correspond with the familiar series of Na I are in the extreme ultra-violet (below 1394 Å.), while the secondary series whose longest line (4116 Å.) falls in the visible violet correspond with series which occur in the infra-red of Na I. The highest term of the Si IV system is 364,117, corresponding to an ionization potential of 44.95 v. Including Paschen's recent work on Al III (cf. preceding abstr.) and F.'s previous work on Mg II (*Trans. Roy. Soc. (London)* 214A, 253(1914)) which also have spectra similar to Na I, data are thus available for the comparison of the spectra given by 4 similarly constituted atoms which differ mainly in the charge of the nucleus, *i. e.*, each has 11 electrons but the nuclear charge increases from 11 for Na I to 14 for Si IV. Comparisons of the doublet sepns., of the wavelengths of chief lines, of series terms and of quantum defects show remarkable regularity for these 4 atoms, the doublet sepns. and series terms when plotted against nuclear charge exhibiting greater regularity than those for elements of the same chem. group.

W. F. MEGGERS

**Refractive indices and absorption constants of the diamond between 644 and 226  $\mu$ .** FRITZ PETERS. *Z. Physik* 15, 358-68(1923).—Measurements of high precision were made of the *n*s. of the diamond from the visible region to  $\lambda = 224 \mu$ . The absorption consts. were measured from  $\lambda = 546 \mu$  to  $\lambda = 226 \mu$ . Complete tables are included of the values obtained by P. and by several other writers.

D. C. BARDWELL

**The ultra-violet absorption spectra of the alkaloids of the isoquinoline group: narcotine, hydrastine, and hydrocotarnine.** PIERRE STEINER. *Compt. rend.* 176, 244-6(1923).—The ultra-violet absorption spectrum of narcotine is influenced by the benzene nucleus of its mol.; that of hydrastine differs from that of narcotine only in a displacement of its max. and min. toward slightly shorter wave lengths, and by slight differences in intensity. Hydrocotarnine, contg. a partially satd. isoquinoline nucleus, gives a single band in the ultra-violet and does not resemble the isoquinoline spectrum. 0.07 mg. of narcotine can be detd. spectrographically in 2 cm.<sup>3</sup> of solvent.

T. S. CARSWELL

**Quantitative investigations of the ultra-violet spark spectrum of copper in aluminium.** XAVIER WACHE. *Compt. rend.* 177, 39-41(1923).—By employing a quartz spectrograph the spark spectrum of Cu alloyed with other metals is studied in the interval 2170 to 4800 Å. with a view to correlating spectral appearance with % compn. and thus furnishing a basis for quant. analysis. For small amts. the quant. indications given by spectral analysis appear to depend on the diluting metal, and in particular on its sp. vol.; Cu is less sensitive in Al than in a denser metal like Zn. The partial spectra of 5% to 0.0005% Cu in Al are represented in a table. The complete spectrum of Cu appears when this metal constitutes about 60% of the alloy. The limit for the production of the entire spectrum of Al is about 20%.

W. F. MEGGERS

**The ultra-violet absorption spectra of eugenol and isoeugenol.** GARTHA THOMPSON. *J. Chem. Soc.* 123, 1594-7(1923).—The object of this work was to test the rule that of two isomeric substances contg. two or more double bonds, that one which contains the longer chain of conjugations will have the greater absorptive power in the region of the spectrum above that in which any absorption bands make their appearance. The general absorption of solns. of known and approx. 0.05 N strength of eugenol and isoeugenol in abs. alc. was studied by means of a quartz spectrograph, a Lewis photometer and a condensed spark between Ni-steel electrodes. The absorptive powers in terms of extinction coeffs. were found in the region 4000 to 2300 Å. and the

ratio of these powers was calcd. over the region 3100 to 3650 Å. It is shown that the above rule may be reversed in certain portions of the spectrum, although these portions may be far removed from those in which selective absorption occurs. For eugenol and isoeugenol the rule applies only at wave lengths between 3320 and 2380 Å. The selective absorption of these compds. was studied with very weak solns. Isoeugenol has very much greater selective absorption than eugenol except at both extremes of the spectrum where eugenol has the greater absorptive power. W. F. M.

**Spectra associated with carbon.** T. R. MERTON AND R. C. JOHNSON. *Proc. Roy. Soc. (London)* 103A, 383-95(1923).—It has been known for many years that, in addn. to the line spectra due to the C atom, there are a no. of band spectra associated with C and H, and C and O, and the precise origin of these band spectra has been the subject of many investigations. The most familiar of these band spectra are the so-called Swan spectrum consisting of band heads at 6188, 5635, 5165, 4737 and 4382 Å., and the Ångström bands with heads at 6623, 6079, 5610, 5198, 4835, 4511, 4393 and 4123 Å. The CH bands constitute another complex group with a principal head at 4315 Å., and two new spectra, the low-pressure CO bands and the "high-pressure" CO bands, were discovered in 1910. In the present investigation an attempt has been made to study the effect of the presence of He upon the band and line spectra of C, and also to find the explt. conditions under which the different spectra can best be isolated. Vacuum tubes with C electrodes were provided with side tubes contg. P<sub>2</sub>O<sub>5</sub> or KOH to absorb, resp., water vapor or CO<sub>2</sub>, and pieces of magnesite which yield on heating a supply of CO<sub>2</sub>. For the admission or removal of H a Pd tube was used. The tubes were excited by induction coil or transformer discharge and condensers and a spark-gap could be introduced into the circuit when required. A single prism spectrograph was employed to photograph the spectra, except the intense ones which were also studied with a grating. It was found that the Swan spectrum, which readily occurs in the flame of burning hydrocarbons and in the C arc, can also be excited by uncondensed discharges in tubes with C electrodes contg. H. It appears much more readily in tubes contg. an admixt. of He, Ne or Ar. The Ångström bands appear in tubes contg. C and O when excited by uncondensed discharges. The CH bands which appear in company with the Swan bands in the blue cone of a Bunsen or Méker burner also appear in tubes with C electrodes and a few mm. H pressure when excited with uncondensed discharge. The high-pressure CO bands are almost completely isolated at pressures above 5 mm. Hg. When CO<sub>2</sub> was first admitted to the tube no trace of these bands was visible but after the discharge had passed for some time and the CO<sub>2</sub> had presumably been reduced to CO by the C electrodes, the bands appeared in the capillary of the tube with uncondensed discharge. The low-pressure CO bands, often called the "comet tail" bands, were also produced alone in tubes contg. about 20 mm. He. A table of wave lengths of the principal band heads between 4249.1 and 6245.9 Å. and their representation in 4 series are given. Unlike the other bands, all of which shade to violet, these comet bands are degraded to the red. When a small quantity of H is admitted to a tube showing the comet bands, these are almost entirely replaced by a prominent set of triplet bands degraded to the red. Wave lengths and series representations are given for these triplet bands which had heretofore not been recognized as a distinct spectrum. Still another type of spectrum was obtained when a condensed discharge with a small spark-gap was passed through a wide-bore tube contg. He at 20 mm. pressure. Under these conditions the comet-tail spectrum disappeared and was replaced by the line and band spectrum of He and by a no. of new lines which are believed to constitute a new line spectrum of C. A table of 46 lines between 3919.00 and 7116.1 Å. is given. It is suggested that this may perhaps be the true arc spectrum of C, which is probably produced only at extremely low pressures. The action of He from a purely explt. point of view is described as enabling discharges to pass when the gases with which it is mixed are present in such small quantities that if the total pressure in the tube were equal to their partial pressure it would be impossible for a discharge to pass. The above mentioned 7 different spectra associated with C are illustrated in reproductions which bring out their main features very strikingly. W. F. M.

**Summary of investigations in the infra-red spectrum of long wave lengths.** W. WENIGER. *J. Optical Soc. Am.* 7, 517-27(1922).—This report is a brief summary of the app. and procedure employed and the results obtained before 1922 in studies of the spectral region included in the interval 50  $\mu$  to 300  $\mu$ . Tables give data on (1) wave lengths of residual rays; (2) transmission of quartz; (3) transmission of long wave-length radiation through various substances; (4) transmission of black paper and lampblack; (5) reflection factors and (6) reflection and transmission factors for various substances. W. F. MCGGERS



**Catalysis. XIX. Photochemical catalysis.** A. K. SANYAL AND N. R. DHAR. *Z. anorg. allgem. Chem.* **128**, 212-17 (1923); cf. *C. A.* **17**, 2811.—A mixture of CO and O<sub>2</sub> in a sealed glass tube after 30 hours' exposure to tropical sunlight is partly converted to CO<sub>2</sub>. If a mixture of NH<sub>3</sub> and O<sub>2</sub> in a glass tube is exposed to sunlight for 20 hours it is partly converted to N<sub>2</sub> and H<sub>2</sub>O. When moist CO<sub>2</sub> is exposed to the sunlight for 75 hours in large, thin glass flasks, enough formaldehyde is formed to be detected with Schiff's reagent. F. L. BROWNE

Absorption spectra of sulfuric acid and nitric acid solutions of phenanthroxazine and-phenanthrazine (FORESTI, MARTORELLI) 10.

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#### 4—ELECTROCHEMISTRY

COLIN G. FINK

Albert Lyndon Marsh. ANON. *Elec. World* **82**, 164 (1923); 1 illus.—Biographical sketch. C. G. F.

Electric furnaces extensively employed in Germany. G. L. CARDEN. *Elec. World* **82**, 179-81 (1923).—Both induction and arc furnaces are used in Germany, the Roehling-Rodenhauser induction furnace appearing to be the most in favor. The arc furnaces in use are mostly of the Bonn or the Gesta types. The Bonn is an arc radiating furnace, while the Gesta is an arc resistor furnace. The results obtained at various German works are described. C. G. F.

High frequency induction furnaces. D. WILLCOX. *Fuels & Furnaces* **1**, 159-62 (1923).—A description of the furnace and its operation is given. The great advantage of this type of furnace is the heat control effected, which makes it possible to heat quickly to the crit. temp. without danger of rising above it. It is possible to heat any portion of a bar without overheating other parts by conduction. D. F. BROWN

A new internally heated electric furnace. ANON. *Electrician* **91**, 63 (1923).—Brief description of a small metal resistor furnace. C. G. F.

Development of the large electric melting furnace (Greaves-Etchells furnace). F. HOBSON. *J. Am. Inst. Elec. Eng.* **42**, 600-4 (1923); *Blast Furnace Steel Plant* **11**, 319-21.—The size of the three top-electrode furnaces is limited by the current-carrying capacity of the largest electrode size available. Provided power can be obtained at a reasonable rate, elec. furnaces of very large capacity can be used as feeders to smaller furnaces. The "Greaves-Etchells" furnace is particularly adapted to large units, as the elec. connections are so arranged that any multiple of two electrodes may be used, and the hearth may at will be switched into the circuit to allow equal distribution of the heat throughout the bath. The hearth is a solid thick magnesite or dolomite-magnesite, rammed and baked in over a Cu plate. Sections of the furnace and diagrams of elec. connections are given. A 60-80 ton furnace of this type is now under construction at the River Rouge plant of the Ford Motor Co. It will have 8 electrodes supplied from 4 banks of transformers having a capacity of 3000 k.v.a. each. The inside dimensions are 20½' × 16' built up of 1" plate. The design is on open-hearth lines with 5 doors, and the furnace tilts endwise. W. R. RUDER

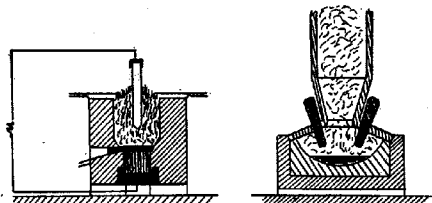
**Electric furnaces for enameling.** C. F. CONE. *Fuels & Furnaces* 1, 180-2(1923).—A description of the furnace and its operation is given. In spite of the high cost of elec. energy it has been demonstrated that the elec. furnace for this purpose is practical and economical. D. F. BROWN

**The use of electric furnaces for melting alloys and for thermal treatment.** FOURMENT. *Technique moderne* 15, 378-81(1923).—A review. A. PAPINEAU-COUTURE

**Current practice of making electric steel.** BRADLEY STOUGHTON. *Chem. Met. Eng.* 28, 983-6(1923).—Different types of furnaces are tabulated and briefly discussed. The cheapest method of making high quality steel in the elec. furnace is to charge molten steel from fuel furnaces. One of the most difficult problems is to avoid serious chilling of the metal. An outline is given of the best methods of furnace practice for cold scrap and hot charges in elec. furnaces. For making an excellent product pure scrap in an acid furnace is recommended. W. E. RUDER

**Electrical reduction of steel directly from iron ore.** CARL SVENSSON. *Teknisk Ukeblad* 41, 8-10(1923).—Investigations made at Stavanger Elektrostaalverk. Attempts with dry reduction of slime by gases gave very interesting but not practically successful results. But the attempts with reduction in an elec. resistance furnace proved entirely successful. The furnace was a low cylindrical shaft with a vault provided with 4 openings for charging and lined with silica. It had 6 water-cooled bottom electrodes of steel and one top electrode. The applied voltage was about 65 v. at 240-50 kw. The ore contained 69% Fe, 1.7 SiO<sub>2</sub>, 0.20 Mn, 0.019 S and 0.013% P. It was fed in sizes of about 30 mm. diam. mixed with coke and limestone. Also a slime of about the same compn., briquetted with coal and a binder, was used with success. The process was conducted in 2 steps. At first a raw steel was produced contg. 1-1.8% C, 0.10-0.20% S and 0.06-0.08% P. This was refined in an elec. steel furnace to steel or wrought Fe with suitable C content. For the reduction to raw steel 380-400 kg. coke and 2500-2600 kw. hrs. were required per ton steel by discontinuous working. The heat of the gases was used to preheat the raw materials. For the refining the required power is the same as in common steel furnaces. The amt. of Fe lost in the slag was 1-3% of the slag weight. The burning losses were extremely small. C. H. A. SYVERTSEN

**Electrical reduction of iron.** H. B. LORENTZEN. *Teknisk Ukeblad* 41, 72-5(1923).—On the ground of his own practical expts. L. discusses the different types of elec. iron-reduction furnaces and particularly compares the two shown by the drawings. (A) has a bottom electrode and a single top electrode. In practice the furnace is provided with a shaft for utilizing the gases. (B) has a number of electrodes arranged in



A. Tinnfos-furnace  
(the author's patent)

B. Grønwall-furnace  
(Elektrometal-furnace)

a circle only 2 of which can be seen in the drawing. (B) works well with charcoal, but not with coke because of the varying resistance of the charge. Using coke (A) is the only type fitted for practical development. The distance between the electrodes can be easily regulated. C. H. A. SYVERTSEN

**Heat treating piston rings electrically.** ANON. *Elec. World* 82, 80(1923).—The heating elements are made up of 3 groups of Ni-Cr ribbons connected in Y to a three-phase, 60 cycle, 230 v. circuit. One kw.-hr. is required to heat 20 lb. of metal to 480°. C. G. F.

**Reduction of difficultly reducible metal oxides with hydrogen.** H. V. WARTENBERG, J. BROY and R. REINICKS. *Z. Elektrochem.* 29, 214-7(1923).—The construction of a durable W furnace (elec.) is described, in which H or N at high pressures can be maintained at 2500° for hours. In this furnace, Cr<sub>2</sub>O<sub>3</sub>, V<sub>2</sub>O<sub>5</sub> and Cr<sub>2</sub>O<sub>3</sub> can be reduced to the corresponding metals with H at 5 atm. pressure. ZrO<sub>2</sub> and ThO<sub>2</sub> can be reduced

in the presence of metals such as W, which dissolve the reduced metal. The reduction of  $\text{ThO}_2$  in the presence of W is discussed with reference to the manuf. of filaments for incandescent lamps. H. JERMAIN CRRIGHTON

**The mechanism of the electric arc.** W. G. DUFFIELD. *Phil. Mag.* **45**, 1139-48 (1923).—A further discussion (*Trans. Roy. Soc. London* **220A**, 109(1919) and *C. A.* **14**, 3358) of the origin of the pressure on the poles of the elec. arc, referring especially to the views of Tyndall (*C. A.* **15**, 797; **16**, 872) and Sellerio (*C. A.* **17**, 241).

**A new equation for the static characteristic of the normal electric arc.** S. C. L. W. N. EDDY AND W. B. NOTTINGHAM. *J. Am. Inst. Elec. Eng.* **42**, 847(1923). C. G. F.

**Operating mercury-arc rectifier sets.** ANON. *Elec. World* **82**, 81(1923).—Instructions for starting and operating the rectifiers. C. G. F.

**Standardization of tungsten lamp voltages.** ANON. *Elec. World* **82**, 85(1923).—Report of the Natl. Elec. Light. Assoc. Comm. C. G. F.

**The quality of incandescent lamps.** J. W. HOWELL AND HENRY SCHROEDER. *J. Am. Inst. Elec. Eng.* **42**, 800-14(1923).—A review. C. G. F.

**Most economical heating (filament temperatures) of vacuum tubes.** H. BARKHAUSEN. *Elektrotechn. Z.* **44**, 616-7(1923).—The W filament temp. should be such that the cost of the heating energy is of the same order of magnitude as the cost of the tube. D. MACRAE

**Dielectric strength ratio between alternating and direct voltages.** J. L. R. HAYDEN AND W. N. EDDY. *J. Am. Inst. Elec. Eng.* **42**, 706-12(1923).—High d. c. voltages are now made available by the use of the kenotron tube. The advantages of d. c. are: (1) lower power requirements; (2) excess d. c. is less liable to do permanent injury to the insulation; and (3) cond. tests can be made, and the action of the material under test can be more thoroughly studied. Tests were made on solid and liquid insulators of homogeneous and non-homogeneous structure, over a range of temp., thickness, and rate of voltage application. The dielec. strength ratio, i. e., the ratio of the direct disruptive voltage to the crest value of the a. c. disruptive voltage, may be considerably greater than unity, or lower, depending upon the material. Ratios lower than unity were found in oils, petrolatum, powd. glass, etc. Ratios higher than unity were noted in paper, cloth, solid glass, mica, etc. In some materials, as laminated paper, the dielec. strength ratio varied with the condition, and in general increased with decreasing temp., decreasing thickness, and increasing rate of voltage application. Combinations of materials, the component elements of which may be near unity, may give very high ratios, as e. g., petrolatum-impregnated cable paper, which has a ratio around two. It is argued that a study of this ratio and its changes with conditions of test will aid materially in the understanding of the mechanism of breakdown of insulation.

W. E. RUDER  
**Electrodeposition of metals. XI. Structure of electrodeposited metal.** W. E. HUGHES. *Beama* **12**, 215-25(1923); cf. *C. A.* **16**, 386; **17**, 25, 26, 930, 933, 1756, 2086.—A general study is made of the chief factors of deposition, and their effects on structure. Chief factors are: current density, temp., agitation, and compn. of the electrolyte. A coarse structure is associated with slow deposition owing to low current density, impoverishment of the soln. layer next to the cathode, excess free acid, low temp., and to a combination of the above factors. A fine-grained structure is associated with rapid deposition owing to high current-density, and high metal concn. of the soln. layer next to cathode. This latter condition is caused by initial high metal concn. of the electrolyte upheld by agitation either mech. or due to convection currents set up by heating, or by rapid evolution of  $\text{H}_2$  at the cathode. The presence of colloids and of simple or complex salts affects the influence of the soln. compn. The concn. of available metal atoms is the all important factor in the formation of the structure of a deposit.

CHAS. H. ELDRIDGE  
**Chromium plating steel using chromium anodes.** K. W. SCHWARTZ. *Trans. Am. Electrochem. Soc.* **44**, preprint (1923).—A series of runs was made with Cr anodes and Fe cathodes, and good deposits were obtained with 200-400 g./l. chromic acid, 3 g./l.  $\text{Cr}_2(\text{SO}_4)_3$ , and 9.3-16 amp./sq. dm. (100-150 amp./sq. ft.). Best results were obtained at a c. d. of 13.4 amp./sq. dm. (125 amp./sq. ft.). No beneficial result was obtained by heating or stirring the electrolyte. However, no Cr plate was obtained unless H in considerable excess was simultaneously discharged at the cathode. Cr metal anodes were used, and no passivity was observed even after many hrs. operation. Chrome-plated steel resists the corrosive action of air satd. with  $\text{NH}_3$  fumes,  $\text{HNO}_3$  or  $\text{H}_2\text{S}$ . Chrome-plated steel is not attacked by molten Sn, Zn or brass. C. H. F.

**Electrodeposition of chromium.** ERIC LIEBRECHT. *Z. Elektrochem.* **29**, 208-10

(1923).—From a study of the current-potential curves for the electrolytic depositions of Cr, it is concluded that the reaction  $\text{Cr}^{++} \rightarrow \text{Cr} + 2\oplus$  takes place, i. e., that the formation of the metal depends on the presence of bivalent Cr ions. If the existence of the equil.  $\text{Cr}^{++} + 2\text{H}^+ \rightleftharpoons \text{Cr}^{+++} + \text{H}_2$  is assumed, this would explain why a greater expenditure of energy is necessary with acidified solns. of chromic acid. The effect of increasing the temp. of the electrolyte is the same as that of weakly acidifying the electrolyte.

H. JERMAIN CRIGHTON  
Electrolytic zinc. M. V. SCHWARZ. *Z. Elektrochem.* 29, 198-207 (1923).—During electrolysis the Zn crystals deposit perpendicularly to the surface of the cathode, in accordance with the general rule for the electrolytic deposition of metals. The Zn deposited on the corners and edges of the cathode is very strong, and very thick deposits have a rough surface which is marked with peculiar streaks. The av. chem. compn. of electrolytic Zn is 99.85 to 99.90% Zn with small quantities of Fe, Cu, Pb and enclosed electrolyte. The marked brittleness of electrolytic Zn is probably due to a higher content of H. The current yield of electrolytic Zn is 94 to 96%, even though scarcely any H is evolved at the cathode. When electrolytic Zn is melted a H flame is observed. If electrolytic Zn is heated for several hrs. at 105° there occurs a loss in wt. of 0.025 to 0.04%, and the Zn then bends easily. When the Zn is more strongly heated it bends suddenly, the cathode side of the plate becoming concave. A marked decrease in d. also takes place. This latter change is most marked at temps. above 180°. On heating at 195° a very marked decrease in the cond. of the metal occurs. The decrease in d. and cond. on heating is not a reversible process, and is probably due to a mech. change in the Zn brought about by the liberation of H and is not due to the transformation of the Zn into another modification.

H. JERMAIN CRIGHTON  
Electrolysis in liquid sulfur dioxide. M. CENTNERSZWER AND J. DRUCKER. *Z. Elektrochem.* 29, 210-14 (1923).—Very unstable products are formed at the cathode when solns. of KI and of NaI in liquid  $\text{SO}_2$  are electrolyzed. Probably the alkali metal first seps. at the cathode, and this then reacts with the solvent to form hyposulfite, which then decomposes into thiosulfate and pyrosulfite. Free S is not liberated. When pure dry liquid  $\text{SO}_2$  is electrolyzed with a high voltage current, S is set free at the cathode. This substantiates Walden's supposition that the electrolytic dissociation of liquid  $\text{SO}_2$  results in the formation of positive S ions.

H. JERMAIN CRIGHTON  
Simultaneous production of oxygen and hydrogen ("Electrolabs" cell). L. H. LEVIN. *Assn. of Iron & Steel Elec. Eng.* 5, 117-76 (1923).—A review of the history and development of the O and H industry, the fundamental considerations in the design of cells and general plant construction and the economic phases of the industry. A plant producing 1,000,000 cu. ft. of  $\text{O}_2$  and 2,000,000 cu. ft. of  $\text{H}_2$  per year costs, complete, about \$40,000, and one producing 12,750,000 cu. ft. costs \$167,000. The operating costs are \$10,200 and \$84,220 resp. A description is given of the "Electrolabs" cell construction.

W. E. RUDER  
Production of sulfuric acid and caustic soda by electrolysis of sodium sulfate. E. R. WATSON. *J. Soc. Chem. Ind.* 42, 251-2T (1923).—S and pyrites are not available in India, while  $\text{Na}_2\text{SO}_4$  is available in *reh* salts. Electrolysis of a 40%  $\text{Na}_2\text{SO}_4$  soln. with Pt, Fe, or Cu cathode and Pt, Pb, or C anode results in the formation of NaOH and  $\text{H}_2\text{SO}_4$  with current and energy efficiencies of 90% and 50%, resp., provided electrolysis is not carried beyond an av. conversion of 25%.  $\text{Na}_2\text{SO}_4$  crystallizes out of the alk. liquor, leaving nearly pure NaOH.  $\text{NaHSO}_4$  is formed similarly from acid liquor.  $\text{H}_2\text{SO}_4$  is best obtained from the bisulfate.

W. H. BOYNTON  
An electrometric method of following certain inorganic hydrolytic reactions. G. S. TILLEY AND O. C. RALSTON. *Trans. Am. Electrochem. Soc.* 44 (preprint).—The air electrode is used to indicate the point of removal of metals from solns. by hydrolysis. The Fe in a discarded leaching soln. was oxidized by  $\text{MnO}_2$  and aeration. Similar oxidation of feruginous clay was investigated. By voltage measurements on the air-calomel electrodes, curves were obtained the level portions of which indicate points of complete removal of the metal. A  $\text{CuSO}_4$  soln. was purified by the addn. of  $\text{CaCO}_3$  and air-bubbling. The curve reached a flat place before all the Fe had been oxidized, showing the ineffectiveness of the electrode in slow oxidation. Viscosity curves presented are in accord with those of Gann. A table of the order in which various common metals begin to hydrolyze is presented. Com. application of the process is specifically suggested.

A. H. DICK  
Maintenance of storage batteries. B. THIERBACH. *Electrotechn. Z.* 44, 563 (1923).

C. G. F.  
Charging control, power and excitation batteries. ANON. *Elec. World* 82, 184 (1923).—Full directions are given for charging.

C. G. F.

## A new material for permanent magnets (GUMMICH) 9.

ARIGO, GIUS AND BURATTI, GIOV. DOM.: Progetto per impianti idro-elettrici della elettrochimica Rossi. Turin: C. Crudo & C. 68 pp.

BUCHNER, GEORG.: Elektrolytische Metall-Abscheidungen. Wissenschaftl. u. prakt. Handb. 2nd revised ed. Berlin: M. Krayn. 304 pp.

GRUHN, KONRAD: Elektrotechnische Messinstrumente. 2nd revised ed. Berlin: Julius Springer. 223 pp.

LOMBARDI, LUIGI: Principi scientifici di elettrotecnica. 2nd ed. revised. Naples: R. Pironti. 496 pp. L. 60.

LOMBARDI, LUIGI: Corso teorico-pratico di elettrotecnica. Milan: F. Vallardi. Vol. 2. 3rd ed. revised. 787 pp.

SPENNRATH, JOSEPH: Einführung in die Grundlagen der Elektrotechnik. 3rd ed. revised by O. Kirstein. Berlin: M. Krayn. 123 pp.

STANSFIELD, ALFRED: The Electric Furnace for Iron and Steel. New York: McGraw-Hill Co., Inc. A complete re-writing of the iron and steel portions of the author's *Electric Furnace*. 453 pp. \$5.

Storage battery. J. D. MINTZ. U. S. 1,460,072, June 26. Structural features.

Storage battery. C. M. ANGELL. U. S. 1,460,010, June 26. Structural features.

Galvanic batteries. R. PÖRSCHKE. Brit. 190,226, Sept. 12, 1921. An electrolyte for a cell having as depolarizer artificial oxide of Mn alone or mixed with natural brownstone consists of a soln. of Ca or Mg chloride or a mixt. of both together with a small quantity of a salt of Hg. The strength of the soln. may vary from 1.05 to 1.35, or from 10 to 40° Bé.

Galvanic batteries. R. PÖRSCHKE. Brit. 189,889, Sept. 12, 1921. A depolarizer consists of chemically prep.  $MnO_2$  which is compressed or rolled under high pressure into tablets, cakes or sheets, which are then ground into powder. The  $MnO_2$  may be mixed before or after grinding with natural brownstone and amorphous C or graphite and may be compressed in a dry or moist state. The ground powder is moistened and pressed round carbon rods.

Zinc cylinders for primary batteries. S. O. COWPER-COLKS. Can. 232,479, July 3, 1923. A Zn battery element comprising a seamless cylinder of electrodeposited metal is formed by electrodeposition on a mandrel the surface of which has been sulfidized. A reinforcing coating of a different metal is then deposited and the reinforced cylinder is removed from the mandrel.

Terminal for electric batteries. L. A. DOUGHTY and F. S. CARLILE. U. S. 1,460,895, July 3.

Terminal for dry batteries. H. M. KORETZKY. U. S. 1,460,969, July 3.

Electrolyzers. W. G. ALLAN. Can. 232,292, June 26, 1923.

Electrodes for electrolytic apparatus. WM. G. ALLAN. Can. 232,293, June 26, 1923.

Electric accumulators. W. O. GARBUTT. Can. 232,684, July 17, 1923. Pb electrodes of an accumulator are desulfated by freeing the plates from acid electrolyte with which they have been used and electrically charging them while immersed in a strong soln. of an alkali oxide or hydroxide.

Apparatus for electrolytic production of paste or sludge metal or alloys. B. LERCH. U. S. 1,461,276, July 10. The app. is especially adapted for manuf. of Sn paste for coating paper.

Electric ozone generator. M. W. WILSON. U. S. 1,461,238, July 10.

Electrolytic cell for hydrogen and oxygen production. G. F. JAUBERT. U. S. 1,461,661, July 10. Ni electrodes and foraminous Ni diaphragms are used.

Melting manganese scrap. W. G. NICHOLS. U. S. 1,460,106, June 26. Mn steel is charged into an elec. furnace and subjected to an elec. arc that is developed by a wattage that is, initially, substantially up to furnace capacity and the heating is continued quickly to bring the charge to molten condition before oxidation can cause material deterioration.

Electric furnaces. W. E. MOORE. Can. 232,651, July 10, 1923. Reissue of Can. 199,557; cf. C. A. 14, 1940.

Electric resistance furnace. E. L. SMALLEY. U. S. 1,459,801, June 26.

Induction furnace having uni-directional circulation. J. R. WYATT. Can. 232,652, July 10, 1923. Reissue of Can. 219,098; cf. C. A. 16, 2455.

Electroplating aluminium. P. A. GOVARRTS and P. M. WENMANCKERS. Brit.

190,500, Dec. 19, 1922. An electrolyte, particularly for use in depositing other metals upon Al, consists of a soluble thiosulfate of the metal to be deposited dissolved in  $H_2O$  or in excess of a sol. thiosulfate. For depositing Fe, a soln. of  $Na_2S_2O_3$  is acidified with an org. acid such as HOAc until decompn. of the thiosulfate just begins, and a small quantity of  $Fe_2SO_4$  is added; the soln. is cooled and filtered. A salt of Zn may also be added to produce an alloy. For depositing Cu, a concd. soln. of  $CuSO_4$  slightly acidified with  $H_2SO_4$  is treated with  $Na_2S_2O_3$  soln. A ppt. is formed which is washed with cold  $H_2O$  and dried rapidly in the cold, e. g., by anhyd.  $H_2SO_4$  in a vacuum, while protected from the action of light. The dried ppt. is dissolved to satn. in warm  $Na_2S_2O_3$  soln. and dild. to double the vol. by further thiosulfate soln. A ppt. similarly obtained from a Ag salt may be dissolved along with the Cu ppt. for depositing an alloy. For depositing brass, a small quantity of the Cu soln. prepd. as above is added to a soln. of  $Na_2S_2O_3$  and  $ZnSO_4$ . This is warmed until the liquid becomes opalescent and then cooled, depositing a small quantity of  $CuS$ , and filtered. An anode of the metal or alloy to be deposited is used in all cases; during electrolysis it may become coated with a non-adherent coating of sulfide. When depositing alloys the voltage may be varied according to the compn. desired. The cathode is cleaned before electrolysis, first mechanically and afterwards with NaOH or potash. After plating, it may be annealed, polished, hammered or burnished. Objects of Al coated with Cu may be gilded.

**Tungsten filaments.** R. D. HALL and H. H. SMITH. U. S. 1,461,117, July 10. Filaments composed mainly of W are formed mainly of large crystals so positioned that objectionable sagging or offsetting is prevented during the commercially useful life of the filament in incandescent lamps. The filaments may be prepd. by heating W filaments contg. small amts. of  $SiO_2$  and  $Al_2O_3$  or Th oxide.

**Tungsten filaments.** R. D. HALL. U. S. 1,461,118, July 10. Filaments of W or similar metal that tends to sag when elec. heated are formed with auxiliary ingredients such as  $SiO_2$  and  $Al_2O_3$  or Th oxide which control the cryst. structure of the filament so as to prevent sagging when subjected to a suitable heat treatment.

**Tungsten filaments.** J. H. RAMAGE. U. S. 1,461,140, July 10. Filaments of W or similar refractory metal, for incandescent lamps, are formed of grains of substantially uniform size by heating fibrous W quickly through and above the crit. temp. and range of rapid grain growth.

**Tungsten or similar filaments.** H. H. SMITH. U. S. 1,461,100, July 10. Filaments for incandescent lamps, formed of W or other similar crystal-forming metal, are subjected to a seasoning heat-treatment which will cause the development of crystals of considerable length, overlapping or interlacing with each other. In the case of W filaments the heating may be at a temp. produced by 2 min. effect of an elec. current of 90-130% of that for which the filament is rated for use.

**Electric lamps.** A. LÖNNERER. U. S. 1,461,359, July 10. The starting potential of elec. lamps which are filled with Ne, He, A, Kr or other gases is lowered by forming in the lamp a thin deposit of an elec.-cond. material such as K, Na, Cs, Rb, Li or Sb by vaporization and deposition. U. S. 1,461,360 specifies a lamp with electrodes of Al, Mg or W or other non-alkali metal and a deposit of a small amt. of Na or other alkali metal.

## 5—PHOTOGRAPHY

C. E. K. MEES

**Chemistry of the acid fixing bath.** S. E. SHEPPARD, F. A. ELLIOTT and S. S. SWEET. *J. Franklin Inst.* 196, 45-67 (1923).—While theoretical investigation can indicate the governing conditions for an acid fixing and hardening soln., a compromise has to be effected in practice. Long fixing life requires as high a concn. of  $Na_2S_2O_3$  as possible. For rapid fixation, the concn. of  $Na_2S_2O_3$  should not appreciably exceed 30%; the total time required is approx. 10 min., probably longer if the soln. be strongly hardening. The bath must not deposit  $Al(OH)_3$  or basic Al compds. even after considerable developer alkali has been added, and must, therefore, contain as much org. acid radical as is otherwise compatible. The  $p_H$  should be approx. 4; if it has an initial value of approx. 3.5, it changes in the right direction as acid is neutralized and buffer salt is formed. Practically, not more than 5% of alum is desirable; this limits the amt. of citrate ion to less than 1% of the total soln.

JOSEPH S. HEPPBURN

**The sensitivity of photographic plates composed of mercury salts.** G. ATHANASIU. *Compt. rend.* 176, 1389-92 (1923).—A. has investigated the spectral sensitivity of the various mercury halides.  $HgI_2$  shows a max. in the green,  $HgI$ , 3300;  $HgBr$ , 3130;

and HgCl, 2967. Luppo-Cramer previously reported that HgBr and HgCl were very insensitive, but this may be explained by the fact that the max. sensitivity of the latter lies in the region of the absorption of glass, making it impossible to obtain a positive image from a glass negative.

H. HARTT  
Preservation of solutions of sodium sulfite. A. SCOTT. *Quart. J. Camera Club* 1, 3(1923).—The reducing power of sulfite soln. falls off rapidly on exposure to the air, the loss being approx. proportional to the time of exposure. The addn. of a trace of hydroquinone to the sulfite soln. efficiently restrains the absorption of atm. O. A suitable proportion of hydroquinone is 1 pt. in 100,000 of a 2% or 5% sulfite soln. The addn. of traces of Cu, H<sub>2</sub>SO<sub>4</sub>, or NaOH to the sulfite has no appreciable effect in increasing or diminishing the oxidation. Pyrogallol acts similarly to hydroquinone, but the effect is less marked.  
J. S. C. I.

VALENTA, EDUARD: Photographische Chemie und Chemikalienkunde mit Berücksichtigung der Bedürfnisse der graphischen Druckgewerbe. II. 2nd Revised ed. Halle (Salle): W. Knapp. pp. 283-616.

## 6—INORGANIC CHEMISTRY

H. I. SCHLESINGER

The constitution of the insoluble alkali metaphosphates. PAUL PASCAL. *Compt. rend.* 176, 1712-4(1923).—The insol. form of NaPO<sub>3</sub> dissolves readily in solns. of an alkali pyrophosphate. This soln. is viscous and metaphosphate is pptd. on the addition of a concd. soln. of Na salt or a few drops of AcOH. The addition of the latter forms a coagulum, which, dried *in vacuo*, has the elasticity of rubber. The dried coagulum, however, is sol. in H<sub>2</sub>O, with which it forms extremely viscous solns. The salt behaves as a colloid, of which certain of the transformations are irreversible. The viscosity at 15° and apparent mol. wt. at various concns. indicate that the insol. alkali metaphosphate has the structure of a polymetaphosphate.

L. T. FAIRHALL  
Preparation at low temperature of sodium metaphosphate. PAUL PASCAL. *Compt. rend.* 176, 1398-1400(1923).—When P<sub>2</sub>O<sub>5</sub> is added to anhyd. Et<sub>2</sub>O the mixt. gradually swells into a translucent colloidal jelly, which soon becomes a viscous liquid. The latter is not a definite substance but contains 8 to 10% of material insol. or slightly sol. in the usual volatile solvents of EtPO<sub>3</sub>, when the prepn. is made at the b. p. of Et<sub>2</sub>O. This product purified by fractional pptn. from CHCl<sub>3</sub> and subjected to a cryoscopic detn. in naphthalene shows a mol. wt. of 662-692 and is probably (EtPO<sub>3</sub>)<sub>4</sub>. When (EtPO<sub>3</sub>)<sub>4</sub> is suspended in an excess of alc.-free anhyd. Et<sub>2</sub>O and EtONa is added in slight excess a violent reaction occurs, yielding a viscous mass; this after washing in warm alc., anhyd. Et<sub>2</sub>O and CHCl<sub>3</sub> gives a product that contains 70.75 to 70.05% P<sub>2</sub>O<sub>5</sub> instead of 69.60%. Cryoscopic tests of the final product agree with the formula NaPO<sub>3</sub>.

L. W. RIGGS

A double salt of magnesium chloride and carbonate. TSUNEKICHI NISHIMURA. *Bull. Inst. Phys. Chem. Research (Japan)* 2, 63-5(1923).—MgCl<sub>2</sub>.MgCO<sub>3</sub>.6H<sub>2</sub>O is prepd. by passing CO<sub>2</sub> into a mixt. obtained by adding a calcd. amt. of MgCO<sub>3</sub> and MgCl<sub>2</sub> to 27.5% or more concd. soln. of MgCl<sub>2</sub>. The salt is decomposed by H<sub>2</sub>O, but is stable toward abs. alc. The compn. of the salt purified with abs. alc. and dried at 40° is 1.00MgCl<sub>2</sub>.1.02MgCO<sub>3</sub>.6.6H<sub>2</sub>O. d<sub>4</sub> 1.679. At 50-60°, one mol. of H<sub>2</sub>O of crystn. is lost; the salt is decomposed above 100°, at which temp. it has the compn., MgCl<sub>2</sub>.3MgCO<sub>3</sub>.7H<sub>2</sub>O. No similar double salt is formed with CaCl<sub>2</sub> and CaCO<sub>3</sub>. K. KASHIMA

Complex compounds of tin. Hydrolysis of stannic chloride and chlorostannates. J. DE LA PUENTE. *Anales soc. españ. fis. quim.* 20, 486-95(1922).—Attention is directed to the possibility of a complete series of compds., H<sub>2</sub>SnCl<sub>4</sub>, H<sub>2</sub>Sn(OH)Cl<sub>3</sub>..., H<sub>2</sub>Sn(OH)<sub>4</sub>, or their alkali salts. SnCl<sub>4</sub> reacts with 4 mols. NaOH, giving Na<sub>4</sub>Sn(OH)<sub>4</sub>Cl<sub>4</sub>; this can also be obtained by the reaction of 1 mol. orthostannic acid with 2 mols. of HCl and NaOH. K<sub>2</sub>SnCl<sub>6</sub> in 1% soln. is completely dissociated into SnCl<sub>4</sub> and KCl. The dissociation is partly prevented by the presence of a large excess of KCl.  
L. E. GILSON

Reaction between selenium and silver nitrate in aqueous solution. F. GARELLI AND A. ANGELETTI. *Atti accad. Lincei* [v] 31, ii, 440-5(1922).—The authors are unable to confirm Guyot's statement (*J. Chem. Soc.* 24, 660(1871)) that, from neutral or acid solns. of salts of the metals, Se dissolved in CS<sub>2</sub> ppts. only Ag as Ag<sub>2</sub>Se. In aq. solns. the Ag may be pptd. completely if excess of Se is used and the liquid is boiled, the reaction corresponding with the equation: 4AgNO<sub>3</sub> + 3Se + 3H<sub>2</sub>O = 2Ag<sub>2</sub>Se + H<sub>2</sub>SeO<sub>3</sub> + 4HNO<sub>3</sub> (cf. Senderens, *Compt. rend.* 104, 1757). From a neutral soln. contg. Ag, Pb

and mercurous or mercuric nitrate, the Ag may be pptd. completely in this way, the amt. of Se added being at least twice that of the Ag in soln., and the liquid being boiled for 15 minutes and filtered when cold. The ppt. is heated with  $\text{HNO}_3$  and the Ag estd. as chloride. Before pptg. Se from a  $\text{HNO}_3$ -HCl soln. of selenious acid Treadwell recommends that the liquid be evapd. to dryness to expel excess of  $\text{HNO}_3$ . This procedure, however, involves loss of Se owing to the volatility of selenious acid. The addn. of alkali chlorides, as suggested by Fresenius, does not entirely overcome this difficulty. If, however, oxidation is effected by  $\text{HNO}_3$  alone, this may be eliminated by evapn. and the residue then taken up in HCl without appreciable loss of Se. J. C. S.

**Tetramethylammonium tri- and tetrachloro-iodides.** W. N. RAE. *J. Am. Chem. Soc.* **45**, 1725 (1923).—A repetition of the work of Weltzien (cf. *Ann.* **99**, 1 (1856)) showed that the supposed compd.,  $\text{NMe}_4\text{I}_3$ , gave low and variable analytical results, and it was probably a mixt. of di- and tetrachloroiodides. An orange solid closer to the compn. of  $\text{NMe}_4\text{I}_3$  than that obtained by Weltzien was obtained by the long continued action of dry Cl on  $\text{NMe}_4\text{I}$  at  $28^\circ$ . C. C. DAVIS

**Penetration of acid amides into complex acetates of iron and chromium.** R. WEINLAND AND H. HACHENBURG. *Z. anorg. allgem. Chem.* **126**, 285–304 (1923).—The complex cation,  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2]$ , can add 1 or 3 mols. of  $\text{NH}_3$  or pyridine. The analogous ferric cation cannot add  $\text{NH}_3$ ; pyridine altered the complex and formed  $[\text{Fe}_4(\text{AcO})_6(\text{OH})_2\text{Py}_3]\text{Cl}_4$  (cf. *C. A.* **6**, 2721; **4**, 2779; **7**, 2729). The present article describes the introduction of feebly basic compds. such as acid amides into these cations. The Cr cation added urea, thiourea and acetamide, usually 1 or 3 mols., but in some cases 2 mols.; the Fe cation added urea only and in all compds. 3 mols. without the alteration of structure caused by pyridine. The new Fe compds. all form brick-red cryst. powders, sol. in cold water with slight acid reaction, hydrolyzed slowly, quickly upon warming, with pptn. of basic acetate, and therefore cannot be recrystd. from water. They are little sol. in cold EtOH, much more sol. in hot; they can be recrystd. from EtOH soln. and metathetical changes of the anion can be effected in it without alteration of the cation. Long heating of the EtOH soln. causes hydrolysis; addn. of pyridine to it causes complete alteration of cation with formation of the above cation with 4 atoms of Fe. From aq. solns.  $\text{NH}_3$  ppts.  $\text{Fe}(\text{OH})_3$  at once. The new Cr compds. are much more stable, better crystd., can be recrystd. from water and the aq. solns. evapd.  $\text{NH}_3$  ppts. no.  $\text{Cr}(\text{OH})_3$  except after long heating. They are less sol. in EtOH than in water and evapn. of the EtOH solns. leaves lac-like residues. In many substitutions of the anion 1 mol. of acid amide leaves the complex. All the Cr salts form deep-green crystals or bright green powders. In a discussion of the constitution of the new salts, following Werner's

formulation,  $\left[ \begin{array}{ccc} \text{OH} & & \text{OH} \\ & \text{ac} & \\ \text{Cr} & \text{ac} & \text{Cr} \\ & \text{ac} & \\ & & \text{ac} \end{array} \right] \text{X}$ , and his conclusion that urea is bound by

residual valences of the O atom and not through one of the N atoms, the mols. of acid amide are linked to the nuclear metal atoms by residual valences of O (S in thiourea). It is pointed out that the loss of water mols. *in vacuo* over  $\text{H}_2\text{SO}_4$  affords support to the spatial configurations proposed by Reihlen (*C. A.* **15**, 2591). The prepn. and analysis of the following new compds. is detailed. Of hexacetato-dihydroxotricarbamido-trisferric cation,  $[\text{Fe}_3(\text{AcO})_6(\text{OH})_2(\text{CO}(\text{NH}_2)_2)_3]$ : chloride, anhydrous and +  $2\text{H}_2\text{O}$ ; nitrate +  $\text{H}_2\text{O}$ ; perchlorate +  $2\text{H}_2\text{O}$ ; tetrachloroferrate ( $\text{FeCl}_4$ ) +  $\text{H}_2\text{O}$ . From the trichromic cation:  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{CO}(\text{NH}_2)_2)_3](\text{AcO})_2 \cdot 2\text{H}_2\text{O}$ ;  $[\text{Cr}_3(\text{AcO})_5(\text{OH})_2(\text{CO}(\text{NH}_2)_2)_3]\text{Cl} \cdot \text{H}_2\text{O}$ ;  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{CO}(\text{NH}_2)_2)_3]\text{Cl} \cdot \text{H}_2\text{O}$ ;  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{CO}(\text{NH}_2)_2)_3]\text{NO}_2 \cdot 3\text{H}_2\text{O}$ . Of the hexacetato-dihydroxo-trithiocarbamido-trichromic cation,  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{CS}(\text{NH}_2)_2)_3]$ , chloride +  $3\text{H}_2\text{O}$ ; nitrate +  $2\text{H}_2\text{O}$ ; perchlorate +  $2\text{H}_2\text{O}$ . Of acetamidocompds.:  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{AcNH}_2)_2]\text{Cl}$  and of  $[\text{Cr}_3(\text{AcO})_6(\text{OH})_2(\text{AcNH}_2)]$ , nitrate +  $2\text{H}_2\text{O}$ ; perchlorate +  $\text{H}_2\text{O}$ . A. R. MIDDLETON

**Physicochemical researches upon the properties and electrolysis of solutions of alkali azides.** E. BRINER AND P. WINKLER. *Helvetica Chim. Acta* **6**, 429–35 (1923); *J. chim. phys.* **20**, 201–16.—A review of previous work. Much of this work has been checked. The research was undertaken partially for the purpose of discovering whether the fixation of N may be more easily accomplished by oxidation or reduction with H. During electrolysis of alkali azides N is liberated in an active form, probably  $\text{N}_3$ , which decomposes immediately to form  $\text{N}_2$  and N. Directing active O upon the anode did not result in the formation of any appreciable amounts of oxide. Active H produced considerable quantities of  $\text{NH}_3$ . Other papers are to follow. C. R. PARK

**Iron and the lower oxides of iron.** J. B. FERGUSON. *Can. Chem. Met.* **7**, 175–6 (1923).—A brief review of the more recent work performed to det. principally the



conditions of temp. and atm. with which mixed iron oxides of a known compn. are in equil., is followed by F.'s own expts., in which  $H_2$ - $H_2O$  (vapor) and  $CO$ - $CO_2$  mixts. were used to prep. samples of oxide; these after analysis were heated *in vacuo*. The compn. of the 3 samples prepd. was (I)  $FeO$  78.16%,  $Fe_2O_3$  21.84%; (II)  $FeO$  87.48%,  $Fe_2O_3$  11.89%,  $Fe$  6.72%; (III)  $FeO$  84.65%,  $Fe_2O_3$  15.35%,  $Fe$  trace. A study of their behavior at temps. up to  $610^\circ$  shows that the main reaction is  $4FeO = Fe + Fe_3O_4$ . The assumption that pure  $FeO$  is stable only at high temps., but that its transition temp. is lowered by admixture of  $Fe_2O_3$  gives an explanation of F.'s results and of Hilpert's (C. A. 4, 882; 5, 2785). A series of expts. at  $750^\circ$  by the stream method to det. the equil. const. gave results agreeing with Chaudron (C. A. 16, 212), 0.54, and at variance with Schriener and Grunnes, who obtained approx. 0.66. — E. G. R. ARDAGH

The reduction of inorganic halides. II. The reduction of titanium tetrachloride. OTTO RUFF AND FRANZ NEUMANN. *Z. anorg. allgem. Chem.* 128, 81–95 (1923); cf. C. A. 15, 3795.—Na amalgam reduces  $TiCl_4$  to  $TiCl_3$ , some  $TiCl_3$  being formed by the interaction of  $TiCl_4$  and  $TiCl_3$ . At slightly elevated temps.  $TiCl_4$  is reduced to  $TiCl_3$  by Al, Mg, Zn, Hg, As and Sn.  $AlCl_3$  is a catalyst for the reduction and in its presence  $TiCl_4$  is reduced quantitatively to  $TiCl_3$  by Al at  $200^\circ$ .  $TiCl_3$  is not decomposed at  $425^\circ$  and 1 mm. pressure, but at  $450^\circ$  conversion to  $TiCl_2$  and  $TiCl$  takes place.  $TiCl_3$  is not vaporized appreciably at  $600^\circ$ ; it reacts violently with water,  $H_2$  being evolved. III. The reduction of zirconium tetrachloride. OTTO RUFF AND RICHARD WALLSTEIN. *Ibid.* 96–116.— $ZrCl_4$  is reduced by a series of metals in the presence of  $AlCl_3$  as a catalyst, to  $ZrCl_3$  at temps. of  $250$ – $300^\circ$ .  $ZrCl_3$  is a brown solid at ordinary temp. and is converted to  $ZrCl_2$  and  $ZrCl$  above  $330^\circ$ . When the dichloride is heated above  $600^\circ$ ,  $ZrCl_3$  and  $Zr$  are formed. — J. A. ALMQUIST

Chemistry and chemical technology of the rare elements. LUDWIG MOSER. *Oesterr. Chem. Ztg.* 26, 67–70 (1923); cf. C. A. 17, 2401.—The occurrence, prepn., properties and applications of Ga, In, Ti, Zr, Th, Ge, V, Ta, Mo, W, U, Pd, Rh, Ir, Ru and Os are reviewed. — D. MACRAE

The dehydration of gypsum. PIERRE JOLIBOIS AND PIERRE LEFEBVRE. *Compt. rend.* 176, 1317–20 (1923).—When gypsum is dehydrated in a current of air dried over  $P_2O_5$  no indication of the hydrate  $CaSO_4 \cdot \frac{1}{2}H_2O$  is obtained even at a temp. of  $60^\circ$ . When, however, the heating takes place in an atmosphere of water vapor at  $760$  mm., gypsum is slowly transformed to this hydrate at  $108^\circ$ , and more rapidly up to  $160^\circ$ . Above this temp. various mixtures are obtained until  $200^\circ$  is reached, when the gypsum is quickly and completely dehydrated. — A. E. STERN

ERRERA, GIORGIO: Trattato di chimica inorganica. 3rd Ed. Palermo: R. Sandron. 530 pp. L. 32.

GOSSNER, B.: Der chemische Bau der Silikate. Tubingen: J. C. B. Mohr. 16 pp.

## 7—ANALYTICAL CHEMISTRY

WILLIAM T. HALL

Simple method of elementary analysis. Y. ASAHINA AND T. MATSUZAKI. *J. Pharm. Soc. Japan* No. 489, 985–1001 (1922).—Dennstedt's method and app. are simplified. The furnace consists of a bent Fe plate 52 cm. long, 27 cm. wide and 3 mm. thick and is supported upon 2 Fe stands; 4–5 Fe plates coated with asbestos are used to cover the combustion tube, which is 75 mm. long and made of hard glass. Heating is done with 4–5 Bunsen burners with wing tops. The usual soda lime and  $H_2SO_4$  tubes are provided before introduction of O or air. The gas tanks are simply 2 ordinary carboys filled with the gas and a small amt. of 50% alkali hydroxide soln. Two reservoir bottles of caustic alkali soln. are provided at an elevation, so that a desired stream of the gas can be driven through the combustion tube by siphoning the alkali hydroxide into the gas tanks.  $CO_2$  is absorbed in a KOH bulb,  $H_2O$  by  $CaCl_2$  halides by metallic Ag, and N by an azotometer. The detailed method and precautions are given for the detn. of (1) H and C, (2) H and C of N-contg. substances, (3) H and C of S-contg. substances, (4) H and C of halogen-contg. substances, (5) simultaneous detn. of halogen with H and C and (6) N. Over 40 typical compds. were analyzed and their results were compared with the theoretical values. 0.05–0.10 g. samples were used and the results are exceedingly satisfactory. — S. T.

Uses of amalgams in volumetric analysis. VIII. Determination of chromium and of chromium and iron in the presence of one another. IX. Determination of tita-

nium and of titanium and iron in the presence of one another. N. KANO. *J. Chem. Soc. Japan* 44, 37-47, 47-53 (1923); cf. *C. A.* 17, 247.—By means of Zn-Hg,  $\text{Fe}^{+++}$  can be reduced to  $\text{Fe}^{++}$  and  $\text{Ti}^{++++}$  reduced to  $\text{Ti}^{+++}$ . If a known quantity of  $\text{Fe}^{+++}$  or  $\text{Ti}^{++++}$  standard soln. is reduced by Zn-Hg and the reduced soln. is added to an acid soln. contg.  $\text{Cr}_2\text{O}_7^{--}$ , the Cr content can be detd. by titrating the excess  $\text{Fe}^{++}$  or  $\text{Ti}^{+++}$  with  $\text{KMnO}_4$  in the usual way. When more than the equiv. of 0.03 g. Cr is present, it is advisable to use a standard  $\text{Ti}^{++++}$  soln. rather than  $\text{Fe}^{+++}$  as a better end point is obtained in the  $\text{KMnO}_4$  titration. For the detn. of Cr and Fe in the presence of one another, first reduce both  $\text{Cr}_2\text{O}_7^{--}$  and  $\text{Fe}^{+++}$  in an atm. of  $\text{CO}_2$  by means of Zn-Hg. The reduction of the Cr results in the formation of some  $\text{Cr}^{++}$ . Introduce air, which oxidizes the latter without appreciably affecting the  $\text{Fe}^{++}$ . Titrate the  $\text{Fe}^{++}$  in dil. soln. with  $\text{KMnO}_4$ . In another portion det. Cr alone by the above treatment with reduced  $\text{Fe}^{+++}$  or  $\text{Ti}^{++++}$  soln., and titrate the excess of  $\text{Fe}^{++}$  or  $\text{Ti}^{+++}$ . For the detn. of Ti and Fe in the presence of one another, reduce both with Zn-Hg and titrate the sum of Fe + Ti with  $\text{KMnO}_4$ . In another analysis, treat the reduced soln. with an equal vol. of unreduced soln. Then, since  $\text{Fe}^{+++}$  oxidizes  $\text{Ti}^{+++}$ , and there is usually more  $\text{Fe}^{+++}$  than  $\text{Ti}^{++++}$  present in the original soln., only the excess of Fe over Ti is detd. by titration with  $\text{KMnO}_4$ . S. T.

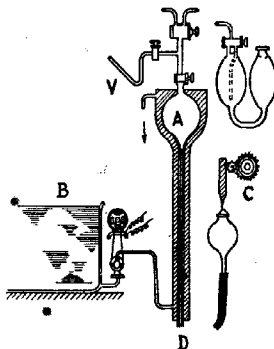
Tungsten wire for hydrogen-ion determinations. J. R. BAYLIS. *Ind. Eng. Chem.* 15, 852-3 (1923).—In the attempt to develop an electrode which does not require the use of a gas and that may be used to indicate  $p_{\text{H}}$  changes resulting from the application of chemicals to a water supply, the W wire in a 40-watt elec. lamp. was found useful for ranges between  $p_{\text{H}}$  6.5 and 8.6. A hole was ground into the light globe large enough for 2 small tubes, one for water and the other for KCl soln. W. T. HALL

The determination of the hydrogen-ion concentration in the range  $p_{\text{H}}$  8.45-10.5 by means of a series of colored solutions. Y. AIRILA. *Acta soc. med. fennic* 3, 104 (1921); *Chem. Zentr.* 1922, IV, 105.—As in the nitrophenol series of Michaelis, a mixt. of fuchsin and Me violet in 95% EtOH shows approx. the same color tints as phenolphthalein in the Walpole comparator. The soln. was prepd. from 0.0125% aq. fuchsin and a satd. alc. soln. of Me violet in 1000 vols. of  $\text{H}_2\text{O}$ . C. C. DAVIS

Estimation of carbon dioxide of dilute concentration. K. SHIKATA AND S. SARUHASHI. *J. Pharm. Soc. Japan* No. 488, 893-907 (1922).—The method is based on the diminution of vol. after absorption in alk. soln. The new features in the app. are: (a) device to keep the air chamber A at a const. temp. by circulating water at a const. temp. from B; (b) finer adjustment of the Hg level by means of C; (c) attachment of the tube (V) in which xylene is placed in order to sensitize the detection of the vol. change. The capacity of A is about 200 cc. The capillary tube, D, is 3.8 mm. long, holds 2 cc. and is graduated for each 0.02 cc. By this app. as little as 0.004%  $\text{CO}_2$  can be detd. The results compare favorably with those obtained by the Pettenhofer method but are slightly lower. S. T.

The determination of carbon monoxide with iodine pentoxide. R. KATTWINKEL. *Brennstoff-Chem.* 4, 104-5 (1923).—CO can be quant. detd. in illuminating gas and in various industrial gases by the use of  $\text{I}_2\text{O}_5$ . This method is applicable to gases containing more than 1.0% CO despite statements of other experimenters to the contrary. Errors will be caused if compds. such as  $\text{C}_2\text{H}_2$ , ethylene, pentane (in amts. exceeding 0.2%) and  $\text{H}_2\text{S}$  are present. The sample of gas to be analyzed is washed with KOH soln., then with concd.  $\text{H}_2\text{SO}_4$ , and is finally passed through a layer of activated C. The gas then enters a U-tube contg.  $\text{I}_2\text{O}_5$ , which is set in an oil bath heated to 110-20°. The I vapors liberated are absorbed in 10% KI soln. and the  $\text{CO}_2$  formed in the reaction by  $\text{Ba}(\text{OH})_2$  soln. The titration of the I is made with 0.001 N  $\text{Na}_2\text{S}_2\text{O}_3$ , and the Ba pptd. as  $\text{BaCO}_3$  is finally weighed as  $\text{BaSO}_4$ . The % of CO as calcd. from the I and  $\text{CO}_2$  values agrees with the result obtained by the use of  $\text{Cu}_2\text{Cl}_2$ . C. T. WHITE

Determination of potassium with sodium cobaltinitrite. E. CLERFFY. *Bull. soc. chim. Belg.* 31, 417-20 (1922).—Numerous analyses indicate that the cobaltinitrite method for detg. K is capable of giving results comparable with those obtained by the



chloroplatinate method. As reagents, prepare a soln. of 28.6 g.  $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$  and 50 cc. of glacial  $\text{AcOH}$  diluted to 500 cc. and another of 180 g.  $\text{NaNO}_2$  in 500 cc. of water. The day before using, slowly add the first soln. to an equal vol. of the second and filter after standing overnight. Add an excess (40 cc. for 0.25 g.  $\text{KCl}$  and never less than 10 cc.) to the concd.  $\text{K}$  soln. (not over 25 cc. in vol.), stir mechanically for 30 mins. and let stand till the next day. Filter, wash with 10%  $\text{AcOH}$  until the filtrate is colorless and then once with 95% alc. Dry at  $120^\circ$  and weigh as  $\text{K}_2\text{NaCo}(\text{NO}_2)_6 \cdot \text{H}_2\text{O}$ . W. T. H.

**The determination of sulfur in iron and steel.** T. ASHIDA. *J. Chem. Soc. Japan* 44, 483-91 (1923).—Mix 2-3 g. of the finely divided sample with 10 g. of  $\text{Zn-Hg}$  in an evolution flask which is provided with a separatory funnel and is connected with 2 wash-bottles contg. water and with absorption flasks contg. ammoniacal  $\text{Cd}$  soln. Treat the sample with an excess of 12  $N$   $\text{HCl}$  added very slowly through the separatory funnel. When the reaction slows down, introduce  $\text{H}_2$  gas, washed through  $\text{CuSO}_4$  soln., and heat toward the last. About 30 min. is required for the expulsion of all the  $\text{S}$  as  $\text{H}_2\text{S}$ . Det. the  $\text{S}$  in the pptd.  $\text{CdS}$  by the usual iodometric method. S. T.

**New method of determining arsenic in steel.** C. MAZZETTI and P. AGOSTINI. *Gazz. chim. ital.* 53, 257-61 (1923).—Andrews and Farr (C. A. 3, 1624) found that Bettendorf's reaction may be used to det. small amts. of  $\text{As}$  (0.0001 to 0.1 g.). M. and A. have applied this method to the detn. of  $\text{As}$  in steel and proceed as follows: Treat 10 g. steel chips in a covered porcelain dish with 80 cc. aqua regia added in small portions. Evap. the soln. to dryness on a sand bath. Take up the residue in 60-80 cc.  $\text{HCl}$  and filter through a Gooch crucible to sep.  $\text{SiO}_2$  and  $\text{C}$ . Place the filtrate in a 500 cc. flask with 75 cc. Bettendorf's reagent (400 g.  $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$  in 1000 cc.  $\text{HCl}$  (d. 1.18)). Close the flask with a Kjeldahl 'pear' and place on a  $\text{H}_2\text{O}$ -bath kept at  $40-50^\circ$  until all the  $\text{As}$  settles to the bottom. Filter the soln. through a Berzelius filter and wash with  $\text{H}_2\text{O}$  until free from  $\text{Fe}$ . Transfer the filtrate to a 100 cc. flask contg. 20-30 cc. of  $\text{H}_2\text{O}$  and heat up the filter. Add 10-15 cc. 0.1  $N$   $\text{I}$  soln. and titrate the soln. in the presence of phosphate or bicarbonate to a violet-red coloration. The results given are accurate and the method is preferable to the more tedious one of Ledebur. E. J. W.

**Estimation of iron in ores and silicate rocks.** F. R. ENNOS and R. SUTCLIFFE. *Summary of Progress Geol. Survey* 1921, 174-6.—In the case of samples contg.  $\text{Fe}$ ,  $\text{Al}$ ,  $\text{Ti}$ , and phosphate, fuse the weighed oxides of the  $\text{Al}$  group with pyrosulfate and est. the  $\text{Ti}$  colorimetrically in the soln. resulting from the fusion. Then evap. the soln. to a vol. of about 100 cc., destroy the excess of  $\text{H}_2\text{O}_2$  by treating the hot soln. with the required quantity of  $\text{H}_2\text{SO}_4$  and sat. the soln. at  $90^\circ$  with  $\text{H}_2\text{S}$ . Sep. the ppt. of  $\text{S}$  and  $\text{Pt}$  sulfide (the  $\text{Pt}$  is derived from the crucible in which the fusion was made) by filtration and wash with very dil.  $\text{H}_2\text{SO}_4$ . Cool the filtrate, oxidize with dil.  $\text{KMnO}_4$  soln., add 10 cc. of concd.  $\text{HCl}$  and 5 cc. of 20%  $\text{NH}_4\text{CNS}$  soln., and titrate the  $\text{Fe}$  with standardized  $\text{TiCl}_3$  soln. J. C. S.

**Gravimetric and volumetric methods for the estimation of tin in alloys.** ANTONIN JILK. *Chem. Listy* 17, 7-11 (1923).—Two methods for the estn. of  $\text{Sn}$  in alloys were examd., namely, the gravimetric method of Czerwek (*Z. anal. Chem.* 15, 505 (1876)) and an iodometric method. The following conclusions were drawn: The  $\text{SnO}_2 \cdot \text{P}_2\text{O}_5$  ppt. should be washed with a mixt. of acids similar to that used to dissolve the alloy but with the addn. of  $\text{H}_3\text{PO}_4$ , and not with  $\text{HNO}_3$  alone, as Czerwek recommends; otherwise antimonious acid, which is insol. in  $\text{HNO}_3$ , would remain adsorbed by the ppt. The soln. of this ppt. in alkali sulfide should not be boiled very long, as a gelatinous ppt. contg.  $\text{SnO}_2$  and  $\text{P}_2\text{O}_5$  tends to sep. with increase in  $\text{OH}^-$  ion concn. In the conversion of the  $\text{SnS}$  into  $\text{SnO}_2$ , the sulfide should be moistened before the addn. of  $\text{HNO}_3$ , as otherwise the violence of the reaction would lead to spattering of the contents of the crucible. A series of analyses of pure  $\text{Sn}$  was carried out, reducing progressively the quantity of  $\text{Sn}$ , but keeping the quantities of the reagents const. As a result, it was found that with the quantities of the latter used [6 g. of  $\text{AcOH}$ , 15 cc. of  $\text{HNO}_3$  (d. 1.4), 30 drops of 45%  $\text{H}_3\text{PO}_4$ , and 15 cc. of water, followed by diln. with 300 cc. of boiling water] the best results are obtained with 0.1 g. of  $\text{Sn}$ . Should more be used, the results are high, while with less, pptn. of  $\text{Sn}$  is slow and incomplete, so that with 0.0022 g. of  $\text{Sn}$ , only 43% was found by this method. The stannophosphate ppt. was examd., and its compn. found to be roughly  $2\text{SnO}_2 \cdot \text{P}_2\text{O}_5$ . This varies with the quantity of  $\text{H}_3\text{PO}_4$  used, and can contain adsorbed  $\text{Pb}$ ,  $\text{Cu}$  and  $\text{Sb}$  salts. For this reason, the  $\text{Sn}$  cannot be estd. by weighing the stannophosphate ppt. J. C. S.

**The titration of sodium formaldehydesulfoxylate.** B. SALKIN. *Ind. Eng. Chem.* 15, 848-9 (1923).—Just as with  $\text{Na}_2\text{S}_2\text{O}_4$ , the titration of  $\text{NaHSO}_2 \cdot \text{CH}_2\text{O}$  is best accomplished with strongly ammoniacal  $\text{CuSO}_4$  soln. The impurities do not decolorize the blue soln. In another portion, det. the  $\text{I}_2$  required to oxidize the sample. The

latter titration is not as good an indication as the former because  $\text{Na}_2\text{S}_2\text{O}_8$ ,  $\text{NaHSO}_4$  etc., react with  $\text{I}_2$  but from the agreement or lack of agreement between the 2 titrations it is possible to predict the nature of the impurities.

**A modified test for phthalates.** R. E. ANDREW. *Ind. Eng. Chem.* **15**, 838(1923).—The use of diethyl phthalate as a denaturant for industrial alc. has necessitated a method for the detection of phthalates in manufactured products or in illegal preps. The proposed test depends upon the development of green or yellow-green fluorescence after treatment with alkali, resorcinol, acid and finally more NaOH. After the addn. of the acid no heat other than that resulting from neutralization is advisable.

**A characteristic reaction of hydroxylamine.** W. N. HIRSCHER AND J. A. VERHOEFF. *Chem. Weekblad* **20**, 319-20(1923).—An ammoniacal soln. of diacetyl monoxime will form dimethylglyoxime in the presence of  $\text{NH}_4\text{OH}$ . This is recognized by its red ppt. with Ni salts; 0.01 mg. can be detected in this way.

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WEINLAND, RUDOLF: *Anleitung für das Praktikum in der Massanalyse und zu den massanalytischen Bestimmungen des Deutschen Arzneibuches V*. 4th revised ed. Stuttgart: F. Enke. 192 pp.

**Gas analysis.** L. D. WILLIAMS and A. WILLIAMS. U. S. 1,459,127, June 19. In gas analysis by absorption of one or more constituents, the sample of gas is initially compressed to reduce errors such as those which might result from the use of samples not satd. with moisture and also to increase the wt. of samples which may be handled in an app. of a particular cubic capacity.

### 8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND EDW. F. HOLDEN

**The color of three varieties of quartz.** EDW. F. HOLDEN. *Am. Mineral.* **8**, 117-21 (1923).—Analyses of 3 specimens of Brazilian citrine (0.008-0.026%  $\text{Fe}_2\text{O}_3$ ) and a comparison of their color with that of colloidal solns. of  $\text{Fe}(\text{OH})_3$  indicate that the pigment of citrine is probably sub-microscopic  $\text{Fe}(\text{OH})_3$  particles. A pink crystal of quartz differed from typical rose quartz (always massive) in being colored by microscopic hematite inclusions (0.043%  $\text{Fe}_2\text{O}_3$ ); this is likely true for all pink crystals of quartz. Rose quartz, from Decring, N. H., which is more bluish than most rose quartz, owes its bluish tinge to an unusual content of fine rutile inclusions (0.029%  $\text{TiO}_2$ ).

E. F. H.

**Notes on Massachusetts minerals.** E. E. FAIRBANKS. *Am. Mineral.* **8**, 130 (1923).—The minerals briefly described are: wollastonite, Stoneham; sheridanite, polydymite, prehnite and other zeolites, Dracut; glaucophane, Lowell; anorthoclase, Arlington Heights.

E. F. H.

**Optical notes on thomsonite.** S. G. GORDON. *Am. Mineral.* **8**, 125-7(1923).—Five specimens of thomsonite from different localities had the  $n_s$ :  $\alpha = 1.516-1.530$ ,  $\alpha = 1.520-1.532$ ,  $\gamma = 1.527-1.542$ . Museum specimens labeled thomsonite may prove to be scolecite, mesolite, or natrolite.

E. F. H.

**Note on the composition of thomsonite.** E. T. WHERRY. *Am. Mineral.* **8**, 121-5 (1923).—Published analyses of "thomsonite" are plotted with respect to the percentages of  $\text{SiO}_2$  and  $\text{Na}_2\text{O}$ , which vary considerably. A study of the diagram shows: The majority of thomsonites have a uniform  $\text{Na}_2\text{O}$  content. The probable formula of normal

thomsonite is  $\text{NaCa}_2(\text{Al}_6\text{Si}_6\text{O}_{30}) \cdot 6\text{H}_2\text{O}$ ; its  $\alpha = 1.520$ ,  $\beta = 1.525$ , and  $\gamma = 1.540$ . A dense clustering of analyses at 41%  $\text{SiO}_2$  indicates the existence of a definite species intermediate between thomsonite and mesolite, optically and chemically distinct, named *faroeite* by Heddele in 1857, probably  $\text{Na}_2\text{Ca}_2(\text{Al}_6\text{Si}_6\text{O}_{30}) \cdot 9\text{H}_2\text{O}$ ;  $\alpha = 1.512$ ,  $\beta = 1.513$ ,  $\gamma = 1.518$  (material from Table Mt., Colo., with 40.3%  $\text{SiO}_2$ ). The frequent excess of silica in "thomsonite" is due to mixtures of thomsonite and faroeite, or faroeite and mesolite. Variation in  $\text{Na}_2\text{O}$  may represent admixture of natrolite in thomsonite. There is no evidence of isomorphism between Ca and Na, nor between  $\text{SiO}_2$  and  $\text{Si}_2\text{O}_5$ .  
E. F. H.

The first discovery of vanadinite in Idaho. H. T. STEARNS. *Am. Mineral.* 8, 127-8(1923).—Yellow-brown tabular crystals of vanadinite occur on manganese limonite at a prospect in the Spring Mt. district, Lembi Co., Ida. The crystals are 2 mm. wide,  $1/16$  mm. thick, with the prism, base and pyramid.  
E. F. H.

Contribution to the study of the torbernite of Cornouailles. WILLY STEINKUEHLER. *Bull. soc. chim. Belg.* 32, 253-5(1923).—The compn. of the mineral corresponds to the usual formula with  $8\text{H}_2\text{O}$ ; its hardness = 2,  $d_{17} = 3.68$ ,  $n = 1.594-1.600$ . R. BEUTNER.

Torbernite from Katanga. W. STEINKUEHLER. *Bull. soc. chim. Belg.* 32, 270-2(1923).—Several samples of this mineral were analyzed by dissolving in  $\text{HNO}_3$ , pptg. Pb and Cu by means of  $\text{H}_2\text{S}$  and repeating this pptn. 3 times after redissolving. All values obtained, which agree with each other, show that this mineral contains more Pb (about 3%) than the torbernites analyzed previously. The following constants of this mineral are given:  $d_{17} = 3.84$ ,  $n = 1.600-1.618$ .  
R. BEUTNER.

Geology of coal in the Austrian states. II. The general geology of coal. W. PETRASCHKE. *Montan. Rundschau* 15, 37-160(1923).—A discussion of the origin of coal as related to the Austrian occurrences, with microscopic descriptions of various Austrian coals and a review of phys. and chem. properties of coal including those of Austria. Geochemical conditions in the origin of Austrian coal are considered and a discussion of geochem. processes in the formation of coal given.  
E. T. ERICKSON.

Further notes on the hydraulic theory of oil migration and accumulation. J. L. RICH. *Nat. Petroleum News* 15, No. 28, 75-84(1923).—Previous theories are reviewed. Additional data concerning the hydraulic theory are presented and applications of this theory to conditions in the Mid-Continent and Western U. S. fields discussed.  
D. F. BROWN.

The regional distribution of petroleum in the sandstone zones of Galicia. K. FRIDL. *Petroleum Z.* 19, 527-34(1923); cf. C. A. 16, 4332.—A comprehensive discussion of the geological features of the oil-bearing regions of Galicia.  
D. F. B.

The petroleum deposits in the Carpathian regions. I. P. VOISESTI. *Petroleum Times* 9, 901-3(1923).—Abstract of paper read at the London Oil Conference. All that is at present known concerning the occurrence of petroleum in these regions is that such occurrences and deposits formed thereby are closely connected with certain zones and lines of dislocation (fractures and more or less fractured folds), and the petroleum may be found in all porous or fissured rocks that are able to store it in some form, and belonging to any geological formations, with the only condition that these rocks should have been directly affected by those dislocations. The general geological features of the region are described and the theory is developed that the petroleum originated from incipient regional metamorphism of the formations of the geosynclinals which are rich in org. remains, especially of plants.  
D. F. BROWN.

BELLINI, RAFFAELLO: Mineralogia. Corso elementare di scienze fisiche e naturali per i licei. Torino: G. B. Paravia e C. 188 pp. L. 10.

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## 9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. S. WILLIAMS

Surface tension and adsorption phenomena in flotation. A. F. TAGGART and A. M. GAUDIN. *Trans. Am. Inst. Min. Met. Eng.* 68, 479-535(1923).—Surface tension measurements are described. Frothing is caused by the sol. constituents of the agent. A change of surface tension of the solvent by the solute produces the frothing. When ore is added the viscosity of the mixture is increased and the froth becomes more permanent. The surface tension is not affected in any way by an insol. oil, such as Nujol. The behavior of various flotation oils at the water surface is studied. The adsorption properties at liquid and solid surfaces were studied by using the froth formed and the rejected soln.

W. A. MUELLER

Application of flotation to antimonial gold ore. T. R. SIMPSON. *J. Chem. Met. Soc. S. Africa* 23, 91(1922).—In a test on the extn. of Au from an antimonial ore contg. 8.3% Sb as stibnite and 123.9 dwt. of Au per ton, a recovery of 53.6% of the Au was obtained by amalgamation. The tailings were ground to pass a 100-mesh screen and subjected to flotation, which yielded a stibnite concentrate (29% of feed) contg. 38.6% of the total Au. The tailings yielded 5.9% more Au to cyanide leaching in 48 hrs., bringing the total recovery to over 98% of the Au originally present. J. S. C. I.

Recovery of zinc dust from furnace waste gases. OTTO BRANDY. *Engineering Progress* 4, April (1923); *Bull. Cleveland Tech. Inst.* 2, 419.—The waste gas is first used for generating steam or heating water and is then passed through air-cooled tubes into a dust filter. Air or gas is sepd. from the solid dust particles and ZnO removed.

W. A. MUDGE

The clarifying plant for the purification of waste water by gas at the new foundry of the Mansfeld copper shale works. F. H. SCHILLING. *Wasser* 18, 51-2; *Chem. Zentr.* 1922, IV, 860.—In the purification of waste H<sub>2</sub>O by gas, the sepn. of suspended matter, which consists chiefly of metallic dust, and oily and tarry constituents, is facilitated by decreasing the velocity. This is illustrated and described in detail.

C. C. DAVIS

The causes of foundry waste. R. W. MÜLLER. *Giesserei Ztg.* 10, 179-81(1923).—A study of waste caused by imperfect methods of casting and incorrect air supply.

C. C. DAVIS

Small Bessemer plants. HUBERT HERMANN. *Ind. Technik* 3, 149-52; *Chem. Zentr.* 1922, IV, 583.—Small Bessemer plants are useful in the production of thin liquid steel castings. The air is forced in only on the surface of the bath and therefore the refining is less rapid and penetrating than in the large Bessemer. Several examples of small Bessemer plants are described and illustrated.

C. C. DAVIS

The working of liquid Thomas pig iron in the stationary Marten furnace with one slag. ARTHUR JUNO. *Stahl u. Eisen* 43, 845-9(1923).—The treatment is with a high-P pig iron. The furnace is charged with rolling-mill waste, lime and mill cinder; the charge is slowly heated and then melted with a full gas flame. After 1.5-2 hrs. a slag has formed from the lime and cinder and metal reduced from the scrap, then 16 tons of pig iron is charged, the gas cut down to avoid too high a temp. due to the reactions taking place and after about 3 hrs. the reduction is complete. The dephosphorization should be completed before decarbonization takes place. The charge sheets show a slag of 16.4% P, of which over 90% is soluble. The method for a 35-ton charge requires about 1,200 kg. lime and gives about 3,700 kg. slag. The older methods require much more lime and give more slag. Tables and charts give the wts. of charges for a series of about 9 runs. A discussion of other plants in the district is given.

W. A. MUELLER

The iron industry of Japan. E. KOTHNY. *Stahl u. Eisen* 43, 777-82, 813(1923).—The ore reserves of Japan lie chiefly in northern province of Ou; some are in Iwate and on the island of Hokkaido. Some magnetic ore is found on the southwestern part of the main island. The most of the ores are imported from China. The coal comes mainly from outside countries. Water power is available to the extent of about 5,000,000 h. p. The imports of ore and fuel and the uses to which most of the metal is put are given for the period of 1897 to 1921. Lists are given of the large producers, of all the steel plants and of their production and specialties.

W. A. MUELLER

Die castings. SAM TOUR. *Ind. Eng. Chem.* 15, 25-8(1923).—The extension of

the use of die casting for making castings from metals having high m. p. (Al, brass, cast iron and steel) depends upon the development of suitable metals from which to construct dies. "Heat cracks" formed by the rapid vol. changes in the surfaces of the die by the sudden temp. changes resulting from the casting process, limit the life of a die.

F. P. FLAGG

**Pouring temperatures of steel castings.** H. K. BRIGGS. *Trans. Am. Soc. Steel Treating* 3, 851-4(1923).—A Widmanstätten structure will result provided the molds cool sufficiently slowly from the molten state. This structure is brittle and may be broken down by annealing just above  $A_{c3}$  for a period of time depending upon the section of the casting. Castings which are not annealed should be poured at as low a temp. as possible.

W. A. MUDGE

**Strain and fracture in metals.** W. ROSENHAIN. *Chem. Met. Eng.* 28, 1026-30 (1923); cf. *C. A.* 16, 3293.—R. explains why slip, once started, stops. A method for distinguishing shock fractures and a cure for season cracking are discussed. How to increase endurance of metal to alternating stress is considered.

V. O. HOMERBERG

**Some measurements of the shape of Brinell ball indentation.** F. E. FOSS AND R. C. BRUMFIELD. *Proc. Am. Soc. Testing Materials* 22, II, 312-36(1922).—The hardness numbers computed from measured diams. alone are practically correct, while those computed from measured depths alone are greater than the true-area hardness numbers and may be greatly in error.

V. O. HOMERBERG

**The structure and related properties of metals.** H. S. RAWDON. *Trans. Am. Soc. Steel Treating* 3, 649-79(1923).—The structure of metals and the different conditions affecting these structures, the effect of structure on properties, and the applications of the microscopy of metals are discussed for C and alloy steels, bronzes, brasses, pure Fe, Pb, Al alloys and Monel metal. Photomicrographs show typical structures.

W. A. MUDGE

**An investigation of the fatigue of metals.** H. F. MOORE AND T. M. JASPER. *Univ. of Ill. Eng. Expt. Sta., Bull.* 136, 100 pp.(1923); cf. *C. A.* 16, 1382.

H. L. OLIN

**Substances intermingled with the crystalline granules of metals.** G. TAMMANN. *Z. anorg. allgem. Chem.* 121, 275-80(1922).—Every cryst. granule in a metal is surrounded by a film of complex substances, owing to the insol. of the latter in the crystals and the resulting accumulation. Therefore metal cannot be recrystd. by heat alone, for only by extreme deformation is this network broken so as to bring the crystals in contact with each other. A study of this network was made by dissolving Cd foil 0.1-0.2 mm. thick in 50%  $NH_4NO_3$ , thus avoiding breaking of the structure by gas. With 200-fold magnification the individual cryst. Cd granules inside the film appeared clear brown and vanished on dissolving, leaving the empty cellular network. Similar Cd foil in HCl left a residue of irregular flakes due to destruction of the net structure by gas. Soln. of Cd foil in 25%  $NH_4NO_3$  in a Pt dish left a network adhering to the bottom whereby it could be washed. It was nearly all sol. in HCl, but a small residue required HF for soln. With Zn, a deposit of  $Zn(OH)_2$  covered the network, but by addn. of a few drops of concd.  $NH_4OH$  to the  $NH_4NO_3$ , the network became visible. Distn. of 5 g. of Cd *in vacuo* left a dark gray residue of 0.8 g. The distillate, in the form of a thick cryst. skin in the condenser tube, left, on dissolving in  $NH_4NO_3$ , a very thin network weighing only 5% of the wt. of the undistd. Cd. A 2nd distn. gave a product sol. in  $NH_4NO_3$  with a residue of very small shreds. The presence of an invisible residue in addn. was inferred by its checking the movement of gas bubbles. Al, Fe, Hg and Ag were reported by Hodgkinson and Coote (cf. *Chem. News* 90, 142 (1904)) to be insol. in  $NH_4NO_3$ . This was verified for Al, Hg and Ag as well as for Mn, Cr and Sb, but not for Fe. Fe required a boiling soln. but after several days at room temp. deposited a hydrated oxide. Bi and Sn were acted upon very slowly. 50%  $NH_4NO_3$  dissolved considerable Co in 2 days at room temp., whereas only after weeks was even a slight amount of Ni dissolved. In 6 hrs. Co gave a rose color, but an alloy of Co contg. 0.25 mol. Ni gave hardly any color. With alloys contg. 0.5 and 0.75 mol. Ni the soln. remained colorless. After 8 days the soln. over Co was opaque, over the 0.25 mol. Ni alloy distinctly rose, over the 0.50 mol. alloy very pale rose, over the 0.75 mol. alloys pale green and over Ni strong green. When Al is added to Fe during manuf.,  $Al_2O_3$  forms a network about the Fe crystals and thus changes its phys. properties.

C. C. DAVIS

**Present state of knowledge regarding fragility of metals.** I. RAFFAELLE ARIANO. *Mel. Ital.* 14, 126-36(1922).—This article considers the practical execution of the flection test with simple shock on notched bars. It describes the testing machines, the details of the tests, and treats of the influence of the type of machine upon the results of tests. Sketches and diagrams of machines and details of tests are given.

R. S. P.

**The micro-examination of metals, with special reference to silver, gold and the**

platinum metals. GEORGE PETCHIN. *J. Roy. Microscopical Soc.* 1922, 1-8; *J. Inst. Metals* 28, 647-8. H. G.

Recrystallization of cold-worked cadmium. MAURICE COOK. *J. Inst. Metals*, (advance proof), 14 pp. (1923).—The recrystn. of Cd on heating after plastic deformation by rolling and compression is considered. Results were obtained to show that small differences in the annealing temp. bring about considerable structural changes. Expts. were also made, with a fixed annealing temp., to ascertain the influence of the time factor. Expts. were made to det. the change in hardness that takes place at room temp. A chill-cast block was divided into 3 parts and these parts were reduced by compression under a load of 50 tons to 66, 44, and 24%, resp. Hardness tests were made immediately after compression, and it was found that the metal reduced 66% was distinctly softer than that reduced 44%, which gave about the same hardness figure as the metal in the cast state, while that reduced 24% gave the highest hardness figure. Tested 18 hrs. after compression, all 3 were found to have softened, and after 2 days, while the least reduced specimen had continued to soften, the remaining 2 hardened somewhat. These 2 commenced to soften again, and after 6 days, while the 66% specimen continued to soften slightly, the other appeared to harden. In the 24% specimen the hardness after 4 days was not very different from that after 2 days, but after 6 days it had softened much more. The further change after 8 days was only slight. Photomicrographs are included. V. O. HOMERBERG

Electric properties of recrystallized silver. MARYA KAHANOWICZ. *Rend. accad. Lincei* (5), 31, [1], 364-6(1922); *J. Inst. Metals* 28, 546.—The recrystn. of a drawn Ag wire, which takes place at about 600° during its heating, has an influence upon the temp. coeff. of its elec. cond., which has up to 570° the const. value of 0.0038 and rises then rapidly, being 0.0049 at 930°; and upon the thermoelec. power (against Pt) which up to 600° is given (in microvolts) by  $e = 68 + 0.8934t + 0.00964t^2$ , and from 795° to the m. p. is given by  $e = 1500 - 3.837t + 0.01382t^2$ . Repeated measurements upon an already heated wire, however, give irregular results, owing to the progress of recrystn. by reheating. H. G.

Properties of tin, especially the density. R. HOFFMANN AND W. STAHL. *Mettall. u. Erz.* 20, 5-8(1923).—Tin of 99.8% purity produced from Bolivian ore at the Wilhelmsburg Works was found to have  $d_4^{20}$  7.312 in a vacuum and  $d_4^{20}$  7.311. J. C. S.

Studies of a prehistoric Grecian axe. Its composition by spectrum and chemical analysis. The partial reconstruction of its metallurgy by means of the metallographic microscope. H. WEISS, DANDURAND AND DURENIL. *Bull. soc. chim.* 33, 439-47 (1923).—An account is given of the examn. of an ancient axe dating, probably, back to 1300 B. C. It is about 96% Cu with small amts. of As, Sn, Pb and traces of other metals. From a study of the photomicrographs of this material it is concluded that the axe was not made from native Cu but that the metal was obtained from a mineral and cast into its present form. J. A. ALMQUIST

The use of various kinds of light in metallography. R. G. GUTHRIE. *Trans. Am. Soc. Steel Treating* 3, 710-19, 757(1923).—Discussion of the optics and mechanics of the metallurgical microscope, photographic plates, ray filters, monochromatic and polarized light. Photomicrographs taken at 300-11000 diams. are given. W. A. MUDGE

Practical radiometallurgy. F. ZACHER. *Feinmechanik* 1, 35-9, 52-9, 71-6; *Chem. Zentr.* 1922, IV, 104.—A review. C. C. DAVIS

Practice on recuperative annealing furnaces. K. G. GUSTAFSSON. *Iron Age* 111, 1782-3(1923).—A new design of recuperative pot-furnace used for annealing steel wire is described. A. BUTTS

New furnace for malleable castings. ALFRED GRADENWITZ. *Iron Age* 111, 1781-2(1923).—The furnace is a 2-ton open-hearth, developed in Switzerland by Edwin Bosshardt. Besides the usual regenerative system, there is a narrow slot opening from the hottest zone of the adjoining gas producers directly into the furnace-hearth. This gives early ignition and a very high temp., which, using the basic process, yields low-C steel of high purity, suited to thin and complicated castings, or use where high malleability is needed. A. BUTTS

The constitution and specification tests of steel and iron. SIEGWART FELDEN. *Apparatebau* 34, 165-8; *Chem. Zentr.* 1922, IV, 473; cf. *Auto-Technik* 11, 15; *Chem. Zentr.* 1922, II, 501.—A description and comparison of new methods of testing and investigations directed toward an explanation of the structural compn. of steel and Fe. C. C. DAVIS

Notes relative to gray cast iron. A. E. MACRAE SMITH. *Foundry Trade J.*



27, No. 346, 3 pp.; *Bull. Cleveland Tech. Inst.* 2, 413(1923).—The influence is given of C, P, S, Mn, Ti, and Al on the mech. properties. W. A. MUDGOS

The metallurgy of the basic Martins process and the influence of the oxygen content on the mechanical working of the ingot iron, especially in regard to red-shortness. HERBERT MONDEN. *Stahl u. Eisen* 43, 782-88(1923); cf. *C. A.* 17, 2698.—Samples, 300 mm. long and square rolled material were used for the test work. Red-shortness becomes less with the increase in temp. The test pieces led to the idea that segregation took place with the oxygen content. These pieces examd. under the microscope showed that the slag inclusions were taken out with the higher chilled temps. Another test was so conducted as to have one end of the piece to be tested heated to a temp. of 1,300°, the other at room temp. This was then quenched in water at 5°. Micrographs show the slag contents of the sections, the cryst. structures and cross-sections of ingots with the defects. W. A. MUELLER

Migration of carbon from steel to ingot iron. O. Z. KLOPSCH and H. F. ROBERTS. *Trans. Am. Soc. Steel Treating* 3, 855-63(1923).—0.8 C steel was heated in close contact with ingot Fe at temps. from 800° to 1000° for 4-64 hrs. Photomicrographs and curves give preliminary data showing the migration of C into ingot Fe as a function of time and temp. W. A. MUDGOS

Nonmetallic inclusions in hypereutectoid steel. E. G. MAHIN and G. B. WILSON. *Ind. Eng. Chem.* 15, 829-32(1923).—In any class of steel, excluding the 1 special case of steel of eutectoid compn., segregation of any dissolved constituent will have an effect on C distribution in all but quenched steel, if this case is to be excepted. This fact will apply to the ordinary 4 elements occurring in small quantities in all C steel, as well as to metallic or nonmetallic elements intentionally added in the manuf. of special steels. It will also apply to those sources of const. contamination known as nonmetallic inclusions, and with this addition—that while ordinary segregation of totally dissolved elements can be nearly or entirely cured by thermal treatment and, to some extent, by forging, no amt. of either forging or thermal treatment that is possible in practice will serve to cure the evil effects of the nonmetallic inclusion, since the relatively small soly. of this material in the solid soln. surrounding it, make its exhaustion by diffusion a practical impossibility. V. O. HOMERBERG

Woody fiber structure and flakes in steel. F. SOMMER and F. RAPATZ. *Stahl u. Eisen* 42, 1708-12(1922).—Woody fiber structure is caused by a no. of small cracks elongated in the direction of rolling, produced by relatively hard non-metallic inclusions, which on rolling or forging split open the surrounding steel. The inclusions which are not plastic at the temp. of rolling are generally basic slag particles. Woody fiber structure may be removed by working to a smaller section or by pressing, whereby the clean surfaces of the racks are welded together. A micro-specimen contg. the cross-section of a flake was cemented and examd. The constituents of the flake were metallic and less carbonized than the surrounding metal. The flake was caused by the segregation of ferrite due to the presence of inclusions which diminished the soly. of ferrite in austenite and displaced the eutectic point in the constitutional diagram. The flakes disappeared on quenching, but low-C zones were probably present. Flakes occur more readily in large than in small ingots, owing to the balling up of the inclusions, but severe forging splits up the nests of slag particles. In steels subject to flakes as little O as possible should be allowed access during melting, and deoxidation should be carried out with C. Steel made by the basic Siemens-Martin process is most liable to flakes. J. S. C. I.

The cause of quenching cracks. KOTARO HONDA, TOKUJIRO MATSUSHITA and SAKAE IDEI. *Trans. Am. Soc. Steel Treating* 3, 729-39(1923).—In small pieces of steel the periphery is harder than the center portion only when quenching is very soft. In a moderate quenching the hardness is everywhere nearly equal, while in a hard quenching the periphery is always softer than the interior because of the presence of the arrested austenite and martensite. Quenching cracks in small pieces of steel occur when the hardness in the center portion is much greater than that in the periphery because of the stress caused by the difference in sp. vol. of austenite and martensite, the sp. vol. of the former being much smaller than that of the latter. The center portion exerts a large tangential tension on the periphery. Cracking usually takes place when the temp. of the quenching specimen approaches room temp., since the difference in sp. vol. increases as the temp. falls. Hardness generally increases with lapse of time in a hard quenching on account of the gradual transformation of the arrested austenite into martensite. Cracking may take place in large specimens in the A<sub>1</sub> range and also in the vicinity of room temp.; the cracking at A<sub>1</sub> is chiefly caused by the stress due to the structural difference between the inner and outer portions (pearlite and austenite) while that at room temp. is due to a similar stress as in small specimens. W. A. MUDGOS

**The potential energy of cold-worked steel.** T. F. RUSSELL. *J. Iron Steel Inst.* (advance proof), 15 pp. (May 1923).—R. estimates the increase in potential energy of cold-worked steel by comparing the properties of steel with those of a plastic body. The existence of a vitreous phase is arrived at by thermodynamic reasoning. The vitreous phase is probably identical with the so-called "amorphous" condition. The estd. thickness of this vitreous layer in cold-worked steel is  $1.84 \times 10^{-4}$  cm., or 184 Ångström units. Such a layer would not be visible under the highest-power microscope. R. indicates the practical difficulties which prevent the quant. measurement of the energy increase of cold-worked steel.

L. T. FAIRHALL

**Tests showing the effect of high temperatures on malleable iron.** T. D. LYNCH AND W. J. MERTEN. *Trans. Am. Soc. Steel Treating* 3, 833-40 (1923).—Annealing temps. of 900-25° are recommended for malleablizing when it is desired to obtain high quality of material with a high degree of ductility. The effect of compn. is important. Malleable Fe may be reheated to the proper temp. without destroying its malleablized structure. Too high a temp. will reestablish a hard and brittle structure. Accelerated cooling produces finer-grained ferrite, tougher and more ductile material.

W. A. MUDGE

**Experiments on the rapid graphitization of white cast iron and a theory for the mechanism of graphitization.** ANSON HAYES, W. J. DIEDERICH and W. M. DUNLAP. *Trans. Am. Soc. Steel Treating* 3, 624-37 (1923).—The results of various heating and cooling treatments for periods of time from 1 to 60 hrs. on specimens of white Fe. Photomicrographs and phys. properties are also included. On passing the crit. temp. the ground mass of the Fe becomes solid soln. and the absorption of massive cementite begins and continues as the temp. rises in consequence of its increased soly. On holding at 1000° massive cementite continues to be absorbed while C is deposited. This deposition continues as the temp. falls until a point is reached where simultaneous pptn. of ferrite and temper C begins. At this temp. the slow extn. of heat will effect complete graphitization.

W. A. MUDGE

**The effect of high-temperature quenching on the microstructure of high-carbon steel.** HOWARD SCOTT. *Trans. Am. Soc. Steel Treating* 3, 593-623 (1923).—Micrographical and macrographical study show that C steel can be made austenitic only when sufficient C is dissolved (at least 1.5%) and maintained in soln. by rapid cooling. The crit. cooling rate for so producing austenite is very slow in comparison with that of martensitic steels cooled from the same temp. The surface layers of the oxidized steel were decarburized in all cases at the high temp. to a depth of not more than 1 mm., producing two distinct surface layers. The outermost layers contained no free cementite and were martensitic. The intermediate area contained some free cementite but there were many twins and other markings in its austenitic matrix. The periphery of cylinders during quenching is under tensional stress and this condition is favorable to the pptn. of troostite. Photomicrographs show typical structures.

W. A. MUDGE

**The relation among tensile strength, hardness and combined carbon in ingot iron.** EMIT SCHUZ. *Stahl u. Eisen* 43, 720-22 (1923).—The different effects of C content and heat treatment are discussed in general. The different C-Fe mixts. are taken up and plotted with the view to establish certain formulas.

W. A. MUELLER

**Influences of various substances on the shrinking of iron.** F. WÜST. *Stahl u. Eisen* 43, 713-20 (1923).—In detg. the shrinking of the metal a device was worked out that magnified the change in vol. In measuring the change the shrinkage due to the cooling and that due to the impurity were plotted side by side. Various metals were investigated as Pb, Zn, Sb, Al, Cu and Sn. The chief work was done with Fe and the common impurities present therein. The effect of  $Fe_2O_3$  in the Fe was also taken up and the curves for varying amounts were plotted. The C varied from 0.15% to 3.39%. The influence of Si was studied above 10%; in this case a different chem. effect enters. The curves of shrinkage due to cooling and that due to the impurities have a tendency to travel parallel but in the case of Si the difference increases with the Si content. P, S, Mn, Ni and Co were also studied and tabulated. For the expts. clean Fe was used as a base and the C content lessened the shrinkage.

W. A. M.

**Experiments on grain growth in iron and steel.** I. L. E. BENSON and F. C. THOMPSON. *J. Iron Steel Inst.* (advance proof), 19 pp. (May 1923).—The present investigation is confined to temps. not exceeding 800° and deals with the influence of the compn. only so far as C and Mn are concerned. Steels were chosen so as to include a series in which the C and the Mn varied separately in order that the effect of these elements on the grain size and the rate of grain growth could be observed. To det. the effect of time and temp. on the grain size, specimens of all the materials were normalized at 950° and

then annealed for different periods at 4 different temps., viz., 350°, 500°, 650° and 800°. At each temp. specimens were annealed for periods of 1, 5 and 20 hrs. except in the case of the 800° treatment, which was 72 hrs. Also at 500° a 10-hr. anneal was included. The results are given in the form of curves.

V. O. HOMERBERG

**Graphite controls gray iron.** J. W. BOLTON. *Foundry* 51, 405-7(1923); cf. C. A. 16, 2835.—Size of graphite flakes influences quality. High-C irons are sometimes stronger than Fe of low C. The need of standard testing methods and research on fundamental principles is shown.

V. O. HOMERBERG

**Tenacity tests for iron.** FRITZ POTT. *Apparatebau* 34, 137-9; *Chem. Zentr.* 1922, IV, 211.—A summary and description of technically useful methods for measuring tenacity.

C. C. DAVIS

**The magnetism of steels.** HECTOR PÉCHEUX. *Compt. rend.* 176, 1387-9(1923).—P. has studied the variation of magnetic properties with the C content of annealed and tempered steels. The permeability decreases regularly with increasing C content for the annealed steels, but this relation does not hold for the same samples after tempering.

J. A. ALMQUIST

**Testing machine for iron and steel bars.** W. AND T. AVERY. *Electrician* 91, 63(1923).—Brief account of a new machine capable of applying a pressure of 60 tons.

C. G. F.

**The resistance to bending under continued shock and the hardness under shock of structural steels.** W. MÜLLER. *Forschungsarbeiten d. Vereins deut. Ing.* No. 24, 247; *Stahl u. Eisen* 42, 547-9; *Chem. Zentr.* 1922, IV, 102-3.—Expts. on 63 different Mn, Cr, Ni and Ni-Cr steels showed that under continued shock the formation of cracks occurred very early and were similar to normal C steels. Complete fracture of the special steels however occurred late and required over 20 times the no. of shocks which were necessary to cause the initial cracks. The continued shock test is not a substitute for the breaking test. Further expts. were made on the hardness under shock by the app. of Wilk, and the results compared with the Brinell hardness. The values of the dynamic hardness were considerably less than those of the static hardness.

C. C. DAVIS

**Microstructural aspects of metals and alloys corroded by acid mine water.** R. J. ANDERSON AND GEO. M. ENOS. *Carnegie Inst. of Tech. Cooperative Mining Courses, Bull.* 5.—The results are given of a microscopic examn. of corroded test specimens of metals and alloys which had been immersed in acid mine waters and previously reported on in Bulletin 4. Many illustrations of test pieces are given. In brasses, the grain size had little if any effect on the rate or nature of corrosion. Selective corrosion was noted in alloy systems where two or more phases were present. In bronzes, the  $\Delta$  is the more resistant phase; while in  $\alpha$ - $\beta$  brass, the  $\alpha$  is the more resistant. Other alloys tested did not appear to show selective corrosion. These included brasses not previously mentioned, Ni-silvers and alloys of 4 or more components. Al and Al alloys pitted badly, with no indications of selective corrosion, but apparently because of conditions due to cold working of the material. Some alloys, particularly bronzes, after corrosion and subsequent cleaning showed hard protective coatings. This was not found true of high-Si iron, high-Cr steel, Cr-Ni-Si steels and nichrome. Some data on corrosion in acid mine waters supplementary to *Bull.* 4 are appended. R. L. BROWN

**Corrosion of copper by salt solutions.** W. MÜLLER. *Z. Metallunde* 14, 286-95 (1922).—Cu is rapidly corroded by sea water, NaCl and MgCl<sub>2</sub> with the formation of a green, basic chloride which readily detaches itself from the metal and therefore does not form a protective coating. Weak solutions of Mg and Ca sulfate corrode Cu very slowly, the metal becoming gradually covered with a white ppt. contg. bluish green flakes of basic sulfate.

J. C. S.

**Corrosion of the lead sheaths of cables by water seeping through concrete.** G. C. BUNKER AND A. H. KHACHADOORIAN. *J. Worcester Polyt. Inst.* Nov. (preprint) 1922, 11 pp.—Examn. of the causes of the breakdown of lead-covered cables at Miraflores Locks on the Panama Canal confirmed the corrosive nature of water seeping through concrete. The action is due largely to the alkali (Ca(OH)<sub>2</sub>) dissolved from the concrete.

J. S. C. I.

**Production of single metallic crystals and some of their properties.** H. C. H. CARPENTER. *J. Inst. Metals* (advance proof) 1923, 28 pp.; *Engineering* 115, 579-82, 636-8; *Nature* 112, 58-60; cf. C. A. 16, 1728.—A general discussion is given on the manner in which crystn. takes place in a liquid metal or alloy. In the production of large crystals of Al it was found that the adjustment between mech. strain and the temp. of heating is very important. A photograph is given of 8 test-pieces, which were subjected to degrees of tensile strain varying from 2 to 10% extension on  $\frac{3}{16}$  in. of the parallel

portion of the test-piece after a preliminary heat treatment to remove work-hardness and to render the crystals equiaxed. After this treatment they were heated to 550° for 6 hrs. The crystals in the test-piece extended 2% are very coarse, and as the strain is increased the crystal diminishes until at 10% it has become quite small. In all of the 8 test-pieces shown, large crystals have formed in the broad heads of the test-pieces, where the strain must have been less. In order to convert a great no. of crystals into a single crystal, 3 treatments, 2 thermal and 1 mech., were found to be necessary. The test-piece in the original condition was cold-rolled, and as a result the crystals were very much elongated and worked into one another. It had first to be heated so that it might be completely softened and new equiaxed crystals of approx. uniform size produced. The most suitable temp. was 550° and the time 6 hrs. It had next to be strained to the required amt., which was equiv. to a tensile strain of 2.4 tons per sq. in. Finally, it had to be heated so that the potentiality of growth conferred by strain could be brought fully into operation. A heat treatment beginning at 450° and ending at 600° over a period of 100 hrs. was necessary. After this treatment about 1 test-piece in 4 was converted into a single crystal over the parallel portion. The ultimate stress of test-pieces consisting of aggregates of crystals varied from 4.5 to 4.7 tons per sq. in., the extension on 3 in., from 36 to 38%. The values obtained in tests of specimens consisting of single crystals varied from 2.80 to 4.08 tons per sq. in., while the extension varied from 34 to 86% as measured on 3 in. These variations in properties were accompanied by differences in the method of stretching and the types of fracture. Five types of fractures are enumerated. Monocryst. test-pieces were also prepd. in round bars. A bar consisting of the usual aggregate of small crystals drew down with a roughening of the surface, the maintenance of a circular cross section, and a cup-and-cone fracture. The single crystals flattened very much in 1 dimension, whereas the other dimension differed but little from the original diameter of the bar, and the end result was not a cup-and-cone fracture but a double groove. The crystallography of Al also is discussed.

V. O. HOMERBERG.

**The equilibrium diagram of the iron-carbon-titanium system.** KANJI TAMARU. *Kikugaku Kenkyujo Iho* 2, 92-100(1923).—Thermal analysis has been made of alloys of Fe, C, and Ti (less than 4.37%). To prep. the alloy, a mixt. of powdered Fe-Ti alloy (Ti 24.69, Al 4.12 and Si 2.00%, the rest Fe), powdered reduced Fe and powdered graphite was made into a paste with gum arabic, pressed into a ball (20 g.) and melted in Tammann's electric furnace in a current of H<sub>2</sub>. When it was melted, a graphite rod was immersed in it to add C. The results of the analyses are given in diagrams and a table. The samples were also microscopically examd. with results as follows: When the quantity of Ti is small, no special phase is developed by Ti. Titanoferrite is formed as is shown by the equil. diagram. There is a relation between the satn. points of C and Ti and Fe.

K. K.

**The industrially important alloys, their conductivity and other properties.** EUG. MAYER. *Apparatebau* 34, 168-9, 185-6; *Chem. Zentr.* 1922, IV, 630-1.—With an explanation of the meaning of the word "alloy" is discussed the capacity of individual metals for alloying with one another and how by alloying, phys. properties such as hardness, extensibility, elec. and heat cond. are controlled. The compn. of the most important com. alloys, particularly the copper alloys, and their uses are included.

C. C. DAVIS

**Memorandum on the use of light alloys for aero-engine construction.** W. ROSENHAIN. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 16(June 1921); *J. Inst. Metals* 28, 761-2.—A summary of previous reports. The use of the following alloys for the purpose named in aero-engine manuf. is suggested. For parts not exposed to high temps.: an alloy contg. 2.5 to 3% of Cu, 12.5 to 14.5% of Zn, and the remainder Al, or a 15% Zn alloy. For pistons and cylinders: an Al alloy contg. either 4% of Cu, 2% of Ni, and 1.5% of Mg, or 14% of Cu and 1% of Mn.

H. G.

**The constitution of strontium-lead alloys.** E. PIWOWARSKY. *Z. Metallkunde* 14, 300-1(1922).—Pb and Sr form one compd., PbSr, m. 676° and contg. 12.35% Sr, and a eutectic, contg. very small amts. of Sr, which melts at the same temp. as Pb-Sr and is completely insol. in solid Pb.

J. C. S.

**The ternary system copper-aluminium-nickel.** C. R. AUSTIN AND A. J. MURPHY. *J. Inst. Metals* (advanced proof), 1923, 41 pp.—The thermal equil. diagram for the Cu-Al-Ni alloys is detd. Photomicrographs, several isothermal diagrams and photographs of the space model are included.

V. O. HOMERBERG

**Aluminium-molybdenum alloys.** H. REIMANN. *Z. Metallkunde* 14, 119-23 (1922).—A series of Al-Mo alloys was produced by reducing molybdenite with Al powder, and the equil. diagram of the alloys was studied. The eutectic contains very

small quantities of Mo and melts at 658°. The liquidus rises sharply from this point, and with only 10% Mo is above 1100°. In cooling alloys contg. more than 10% Mo an arrest point was noticed at 1130° and a second one at 735°. In all the alloys a fern-like structure, consisting of needles of  $\text{Al}_3\text{Mo}$  or  $\text{AlMo}$ , is present, and this appears to be absolutely insol. in Al and has a great tendency to settle to the bottom of the molten alloy. Mo rapidly increases the hardness of Al, but renders it exceedingly brittle, so that not more than a few hundredths % could be introduced into any com. alloy. J. S. C. I.

**Aluminium alloys as bearing metals.** GOODMAN. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 15, 322-8 (June 1921); *J. Inst. Metals* 28, 761.—Al alloys are not suitable for use as bearing metals on account of the high friction and tendency to seize, even with loads of 500 lb. per sq. in. Gudgeon-pin bushes made of duralumin, or of an alloy contg. Cu 3, Zn 20 and Al 77%, were found to be satisfactory if the bush was allowed to float in the small end of the connecting-rod and on the gudgeon-pin. H. G.

**Wrought aluminium alloys.** W. ROSENTHAL, S. L. ARCHBUTT, R. G. BATSON AND F. S. TRITTON. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 17, 335-52 (June 1921); *J. Inst. Metals* 28, 580-1.—An alloy contg. Zn 20, Cu 2.5, Mn 0.5, and Mg 0.5%, after rolling extruded bars followed by quenching from 350° and aging, had the following mech. properties—elastic limit 20 tons per sq. in., ultimate stress 37 tons per sq. in., elongation 11%, reduction of area 12%. The tensile strength and ductility may be altered by quenching at slightly lower temps. The addn. of 2.26% of Ag to a 7% Cu-Al alloy increases its ductility at high temps. without affecting the tensile strength. The tensile strength and ductility of rolled 18% Zn-Al alloy are not affected by the addn. of small proportions of Fe and Si, but the resistance to shock is considerably reduced. Tabulated results of the tensile strength and elongation of a considerable no. of Ni-Mg-Cu-Al and Mn-Mg-Cu-Al alloys after rolling into bars are given, showing the effect of temp. on these properties. H. G.

**Constitution of some alloys of aluminium with copper and nickel.** KATHLEEN E. BINGHAM AND J. L. HAUGHTON. *J. Inst. Metals*, (advance proof) 1923, 42 pp.—The system Cu-Ni-Al has been investigated up to 12% Cu and 10% Ni. The partial equilibrium diagram, a photograph of the space model and many photomicrographs are given. V. O. HOMERBERG

**Hardness tests of aluminium alloys.** F. C. LEA, E. COUPLAND, R. G. BATSON AND C. A. EDWARDS. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics*, No. 10, 220-43 (June 1921); *J. Inst. Metals* 28, 579-80.—In detg. the hardness of Al alloys by the Brinell ball machine, the time of application of the load has very little effect on the results obtained either at 15° or at 300°. A large no. of tests on various Al alloys at temps. between 25° and 400° show that alloys contg. Cu, either alone or with other minor constituents, are harder at all temps. than Cu-free alloys, and that the hardness increases with the Cu content. Zn alloys, on the other hand, while nearly as hard as those of Cu at 15°, lose their hardness with great rapidity with increasing temp., and the presence of Zn in Cu-Al alloys causes them to become softer at high temps., whereas Fe and Mn have the reverse effect. Expts. carried out to compare the results obtained by the Brinell test with those given by the Ludwik cone showed that with light alloys the relation between the two sets of figures is only approx. const. In either case the measurement of the depth of indentation gives reliable results, even if the surface is distorted. With the impact cone test the energy of the blow is proportional to the vol. of the indentation, but this relationship is not quite true for the impact ball test. The relation between the Brinell hardness numbers ( $y$ ), and the diam. of impact hardness impression in mm. ( $x$ ), is given by  $y = 7852/x^2$ . Finally, it is shown that the hardness numbers, whether detd. statically or by impact, do not give a measure of the tensile strength of light alloys. H. G.

**Tensile strength of aluminium alloys at high temperatures.** NAT. PHYS. LAB. AND F. C. LEA. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 2, 9-36 (June 1921); *J. Inst. Metals* 28, 582.—The results are given of 7 investigations on the properties of Al alloys at high temps., with a view to finding a suitable alloy for the cylinders and pistons of aero-engines. With increasing percentages of Cu to 14% the tensile strength of Al is increased at ordinary temps., but with rise of temp. slowly falls to 250°, then rapidly. Addn. of Mn up to 2% to Cu-Al alloys tends to arrest the fall in tensile strength up to 250°, when the Cu does not exceed 8%. With larger proportions of Cu, Mn actually increases the tensile strength with rising temps. to 250°, the max. effect being obtained with an alloy contg. 14% of Cu and 1% of Mn, although variations of the latter constituent between 0.8 and 1.7% have no deleterious effect. Alloys contg. 12% of Cu and 2 to 3% of Ni have a higher tensile strength than the

1:14 Mn-Cu alloy at ordinary temps., but the reverse is true at 250°. The Ni-Cu alloys have the remarkably high thermal cond. of 0.42, which is considerably better than that of any other alloy of equal strength so far tested. The addn. of 1.5% of Mg to the 2:8 Ni-Cu alloy causes it to retain its tensile strength up to 250°. The sand-cast alloy being stronger than the chill-cast, tests were carried out to det. the effect of annealing at 350° and 450°. In each case the alloy was weakened, although its strength at 250° was as great as that of the Mg-free alloy at ordinary temps. Further work on these alloys showed that equally good results could be obtained with an alloy similar to the above, but contg. only 4% of Cu.

H. G.

**Thermal expansion, growth, distortion, and aging of aluminium alloys.** F. C. LEA, G. A. SHAKESPEAR, W. ROSENHAIN, S. L. ARCHBUTT, D. HANSON AND L. J. WILLS. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics*, No. 4, 40-59 (June 1921); *J. Inst. Metals* 28, 588.—Al pistons, on heating above 250°, continue to increase in size although the temp. remains const. This increase is the growth, and is more or less permanent. At the same time a more or less permanent alteration of shape, or distortion, takes place. Subsequent heating and cooling may slightly modify these changes, which are never sufficiently great to account for the seizures which sometimes occur with Al pistons; these are probably due to the large coeff. of expansion of Al alloys, which is more than  $2\frac{1}{2}$  times that of cast Fe. Tests on a 4-in. piston gave a max. growth of 0.0032 in. and a distortion of +0.0016 in. on one diameter, accompanied by -0.0009 in. on another. The rate of increase of length of bars of Al alloys rises with the temp. Prolonged heating at 260° results in a further very slight increase during 320 hrs. Subsequent cooling and further heating result in regular contraction and expansion, resp. The coeff. of thermal expansion for the 12% Cu alloy is  $26.4 \times 10^{-6}$ , and for the 14% Cu, 1% Mn alloy,  $25.9 \times 10^{-6}$ . The tensile strength of Cu-Zn-Al alloys increases 26 to 33% on prolonged aging at ordinary temps.; that of Cu-Fe-Al alloys does not appear to be affected under similar conditions.

H. G.

**Thermal conductivity of aluminium and its alloys.** EZER GRIFFITHS AND G. A. SHAKESPEAR. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 7 108-35 (June 1921); *J. Inst. Metals* 28, 581-2.—The thermal cond. of Zn, cast Fe, Al and its alloys, up to 800° to 400° had been detd. by an abs. method in which the heat transmitted along a bar of the alloy is measured by a flow calorimeter. The rods are enclosed in magnesia-asbestos lagging to decrease radiation losses, and corrections are applied for the heat transmitted through this. The rod is heated at one end by a coil of nichrome wire, the elec. input being measured as a check on the heat input. The other end of the rod is maintained at 40°, and temps. at various distances along the rod are measured by means of Fe-constantan thermocouples. The results obtained by this method are in fairly good agreement with those obtained by heating a uniform rod at the ends and measuring the temps. at 3 equidistant points when the rod is in equil. with its surroundings. The figures obtained by both the above methods are tabulated, and the following conclusions are drawn: The cond. of Al alloys is always less than that of the pure metal. The cond. of Al alloys increases with the temp., while that of Al remains const., and that of Zn and of cast Fe decreases. The cond. of sand-cast alloys is slightly lower than that of chill-cast. Annealing at temps. up to 450° increases the cond. in practically all cases, especially in the alloy contg. 14% of Cu and 1% of Mn. Ni-Cu-Al alloys have a comparatively high cond. Mn decreases the cond. of Cu-Al alloys, but annealing at 450° improves it again. The cond. is not affected by over-straining or by treatment with Na silicate.

H. G.

**Linear contraction of aluminium alloys during solidification in the mold.** W. ROSENHAIN AND S. L. ARCHBUTT. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics*, No. 3, 37-9 (June 1921); *J. Inst. Metals* 28, 583.—The percentage contraction of 11 Al alloys contg. Mn, Cu, Zn, and Sn has been detd. The Zn alloys show the greatest contraction, the 15% alloy giving a result of 1.42%, while the Cu, Cu-Sn, and Cu-Mn alloys gave results between 1.22 and 1.25%.

H. G.

**Impact tests on aluminium alloys.** F. C. LEA AND R. G. BATSON. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 11, 245-72 (June 1921); *J. Inst. Metals* 28, 580.—Alloys contg. Cu, Mn, and Al, with or without a small proportion of Sn, show no reduction of impact strength up to 250°, but the values of impact resistance are very low. Zn-Cu or Zn-Cu-Sn alloys with Al show, however, a marked decrease in resistance to impact with increasing temp. Plain Cu-Al alloys absorb less energy the higher the Cu-content, both at 20° and 250°, chill-castings absorbing more than sand-castings. Alloys of the type of duralumin exhibit marked reduction in energy absorption above 150°, while practically all Sn alloys fracture more readily at high temps. than at 20°.

H. G.

**The effect of low temperatures on aluminium alloys.** NAT. PHYS. LAB. AND ROY. AIRCRAFT FACTORY. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 6, 92-106 (June 1921); *J. Inst. Metals* 28, 582.—A large no. of tests of the tensile strength of Cu-Zn-Al, Cu-Mn-Al, and Zn-Sn-Cu-Al alloys at temps. down to that of liquid air showed that there was no appreciable decrease in the strength of these alloys either at the low temp. or after regaining ordinary temps. The tensile strength increases as the temp. falls, but regains its former value when the alloy reverts to ordinary temps. No breakdowns due to the excessive cooling action of the air on days of severe frost were ever experienced in starting up aero-engines having cylinders of Al alloys. H. G.

**Cerium in aluminium alloys.** H. W. GILLET and V. H. SCHNEE. *Ind. Eng. Chem.* 15, 709-11 (1923).—The Ce used in making up the alloys contained other members of the Ce group. Ce appears to be without any useful effect in the light cast Al-Cu alloys. G. and S. believe that in the usual run of good metal used for casting alloys, the use of Ce would be an expense not attended by any benefit. V. O. HOMERBERG

**The influence of iron on aluminium alloys.** F. C. LEA, C. A. EDWARDS and L. J. WILLS. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 8, 136-212 (June 1921); *J. Inst. Metals* 28, 583-4.—For the prepn. of Al alloys contg. iron a hardener contg. 20% of Cu, 10% of Fe, and the remainder Al is prep'd. This alloy melts at 865°, and can be melted directly with Al. Addn. of 1% of Fe to Al alloys contg. 6 to 12% of Cu tends to improve the strength at high temps., but increases the difficulty of getting good castings. Larger quantities of Fe cause the metal to draw and be porous; with 0.5% of Mg in addn. the casting is rendered easier and the resulting alloy has a silvery luster. The tensile strength and elastic limit are improved, but the ductility is diminished; the two first-named properties fall off but slightly up to 250°, but rapidly at higher temps., while the ductility increases rapidly above 250°. The effect of 2% of Fe in an alloy contg. 2 to 3% of Cu, 13 to 14% of Zn, and the remainder Al, is to give it a fine-textured structure, render it very brittle, and cause the castings to draw; it has, however, no effect on the tensile strength. H. G.

**Influence of phosphorus upon aluminium alloys.** LUIGI LOSANA. *Giorn. chim. ind. applicata* 5, 67-70 (1923).—P. up to 0.1%, slightly improves the mech. properties of Al, while higher amts. rapidly cause a decrease in tensile strength and elongation. The action of P is beneficial in so far as it acts as a reducing agent: alloys contg. Cu (oxidizable metal) are improved in a greater proportion than those contg. Ag (non-oxidizable). In alloys with Sn even very small amts. of P produce deleterious effects.

ROBERT S. POSMONTIER

**Alternating-stress tests of aluminium alloys.** G. A. HANKINS. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics* No. 12, 274-80 (June 1921); *J. Inst. Metals* 28, 580.—The results are given of a no. of tests made to det. the resistance of various rolled Al alloys to alternating bending stress at 20, 150, and 180°. The limiting fatigue range of the best Al alloys up to the present is  $\approx 10$  tons per sq. in. at 20°, and  $\approx 8$  tons per sq. in. at 150°. H. G.

**Aluminium die-casting.** F. A. LIVERMORE. *Engineering Production* 5, 190 (1922); *J. Inst. Metals* 28, 825.—The greater part of this article is devoted to the die-casting of Al alloys, and the difficulties to be overcome if good castings are to be obtained. An alloy contg. Al 92, Cu 7%, and Mn 1% gives very good results, as it possesses the necessary properties, low m. p., high tensile strength, and ductility at a temp. just below the point of solidification, properties which are not associated with the majority of common Al alloys. In the actual process of die-casting the dies are heated to about 260°, while the alloy is poured at about 10° above its m. p. For Al die-castings not exceeding 1 in. in any direction, an accuracy of 0.0005 in. can be obtained. Al die-castings weighing as much as 30 to 40 lb. are now being produced in considerable quantities. Construction of dies and operation of die-casting machines are dealt with briefly. H. G.

**Permalloy, an alloy of remarkable magnetic properties.** H. D. ARNOLD and G. W. ELMEN. *J. Franklin Inst.* 195, 621-32 (1923).—Permalloy is a generic name for a group of alloys of Ni and Fe contg. more than 30% Ni. When properly heat-treated, these alloys possess remarkable magnetic properties, e. g., high initial permeability. To attain the max. initial permeability, cooling must occur only through the proper temp. ranges and at the proper rate. The best compn. for the alloy is approx. 78.5% Ni and 21.5% Fe; after heat-treatment, this alloy exhibits larger magnetostriction than does Fe.

JOSEPH S. HEPBURN

**Light alloys containing nickel and copper, and magnesium, nickel and copper.** F. C. LEA. *Repts. of Light Alloys Sub-Comm., Advisory Comm. for Aeronautics*, No. 9, 212-19 (June 1921); *J. Inst. Metals* 28, 584.—Al alloy contg. Cu 4, Ni 2, and Mg

1.5% maintains its strength at 250°, has a high elastic limit, good heat cond., and a considerable resistance to corrosion. After hot-rolling it has an ultimate strength of 17 to 18 tons per sq. in., and an elongation of 19%; after heat-treatment these figures can be increased to 23 to 24 tons and 20 to 24%, resp. The alloy is prepd. by the addn. of 20% Ni-Al and 50% Cu-Al hardeners to molten Al, followed, after skimming, by the requisite quantity of Mg, which is pushed well below the surface of the alloy. The Ni hardener is made by adding Ni shot a little at a time, with const. stirring to molten Al, waiting before each fresh addn. until that previously added has completely dissolved. The 20% Ni alloy melts at 780°, and should be cast at 830°. Curves showing the variation in tensile properties with the temp. and stress-strain curves at different temps. and after different phys. treatments of the alloy are given. H. G.

**Alloys resistant to mineral acids and their application to the construction of apparatus.** B. WÄRSER. *Apparatebau* 34, 129-33; *Chem. Zentr.* 1922, IV, 222.—The phys. properties, method of working and applications of Krupp V2A Steel (Cr-Ni steel) and the Si alloys of Fe are discussed. C. C. DAVIS

**X-rays as a means of determining the composition of alloys.** T. S. FULLER. *Gen. Elec. Rev.* 25, 746-50 (1922).—F. suggests a new use of X-rays in the study of metals. By detg. the comparative absorption power of an unknown alloy with a carefully prepd. set of standards of the same thickness it is possible to arrive at a close approximation of the compn. of the unknown, provided all other observable phys. facts, such as color, hardness, etc., are given proper weight. The method is illustrated by an example of a Cu-Zn alloy, whose compn. it was necessary to know without destruction of the sample. W. E. RUDER

**Pressure-casting alloys.** H. H. KALPERS. *Aluminium* 3, No. 43 (1921); *Bull. Cleveland Tech. Inst.* (3) 1, 47; *J. Inst. Metals* 28, 825-6.—The method of casting under pressure, using permanent molds, has made great strides in the last few years, especially in so-called "white metals." Since the discovery of a special steel for the molds, capable of resisting the effects of molten Al, many articles are produced in this way from Al alloys. Fruitless attempts were made to apply this method to bronze and brass, but no steel could be found for the molds capable of withstanding these alloys in the molten state. Results achieved with the lighter alloys were as satisfactory as the attempts with brass and bronze had proved disappointing. A Zn alloy frequently used consists of Zn 87.5, Sn 8, Cu 4, and Al 0.5%, with the following characteristics: silver-white appearance, melts at 416°, breaking strain 11.3 kg./mm.<sup>2</sup>, compression strength 10.5 kg./mm.<sup>2</sup>, elongation 2%, Brinell hardness 64. It is not used for parts over 4 kg. in weight. Contraction does not exceed 1/1000. This is a very suitable alloy for motor-car accessories, calculating machine parts, etc. The most suitable Al alloy contains Al 92, and Cu 8%. It has a silver-white appearance, melts at about 630°, has a breaking-strain of about 15 kg./mm.<sup>2</sup>, elongation 1.5%, and Brinell hardness 60.5. Parts over 2.5 kg. weight are not made of this alloy. Hardness depends upon the amt. of Cu, and can therefore be regulated at will. The compns. of 5 Sn alloys are given. All melt under 230°, are rarely used for parts over 5 kg., but much used for surgical instruments, galvanometers, and generally where a breaking-strain of over 6 kg./mm.<sup>2</sup> is not requisite, but where stress is laid upon resistance to corrosion. Water and acids do not affect them, and by eliminating the Pb from the compn., they may be suitably employed as food containers. Four Pb alloys are quoted. Castings are made up to about 7 kg. The m. p. is about 315°, and shrinkage under 1/1000. H. G.

**Ferrobronzes.** W. J. MAY. *Mech. World* 69-70, 389 (1921); *J. Inst. Metals* 28, 594-5. H. G.

**The causes of reaction expansion in amalgams.** A. W. GRAY. *Phys. Rev.* 19, 405-6 (1922).—An explanation of the alternating contraction and expansion of a dental amalgam during and after hardening. The rapid drop to a min., forming the first section of the typical curve of reaction expansion, represents the end of the period where there is a preponderance of the contraction accompanying soln. of the alloy in the Hg and formation of Ag<sub>2</sub>Hg<sub>4</sub>. Crystn. of Ag<sub>2</sub>Hg<sub>4</sub> quickly follows its formation. The first min. of the curve is the point where the rapidity of expansion accompanying this crystn. just equals the rapidity of contraction caused by the simultaneous formation of Ag<sub>2</sub>Hg<sub>4</sub>. As the soln. and reaction decrease, crystn. expansion predominates, indicated by the curve rising to the first max. Mixing the alloy with Hg reduces the particles to very small size, but they remain much larger than mols., so there is a gradual inward diffusion of the free Hg coating the alloy particles, resulting in long continued soln., reaction and crystn. The vol. changes from this diffusion account for the slow descent of the reaction expansion curve after reaching the first max. and the very much slower rise following. C. C. DAVIS



The bearing metal "Thermit." G. v. HANFSTENGL. *Z. Ver. deut. Ing.* 67, 455(1923).—A new bearing metal is put out by Th. Goldschmidt A. G. contg. Ni, Pb, Sn, and "other elements." It is claimed to be equal to or superior to ordinary white metal but to melt at least 120° lower. The pouring temp. for white metal is given as 600°, for "Thermit" metal 480°.

H. L. BADGER

Experiments upon elasticity of duralumin. ARISTIDE GIANNINELLI. *L'Industria* 35, 299-301(1921); *J. Inst. Metals* 28, 588.—A stretched bar of duralumin of 21.45 × 9.55 mm. square section and 100 mm. length shows a deformation proportional to the stress up to 1200 kg. total weight, but when the stress is successively raised to 2000, 3000, 4000, 5000, and brought back to 0 every time, the elongations by falling stress are always greater than by rising, some residual elongation being left after stress. These phenomena of elastic hysteresis of duralumin are, however, much smaller than for Cu. The following figures are given for the elastic properties of duralumin. For bars of 21.5 × 9.5 mm. cross-section or 16.2 mm. diam. elastic modulus  $E = 7300$  to 7200 kg./mm.<sup>2</sup>; for a cross-section of 15 × 1.5 mm.,  $E = 6900$ ; for a cross-section of 15 × 1 mm.  $E = 6500$ . For a bar of 15 × 1 mm. section, breaking stress = 34-7 kg./mm.<sup>2</sup>, elongation 14%; for a bar of 15 mm. diam., breaking stress = 46-9 kg./mm.<sup>2</sup>, elongation 9%; for an American duralumin (8-14 mm. diam.), breaking stress = 33-4 kg./mm.<sup>2</sup>, elongation 8-10%. No analyses of the samples used are given.

H. G.

Use of molten salts in heat treatment. WM. J. MERTEN. *Forging and Heat Treating* 9, No. 3(1923); *Bull. Cleveland Tech. Inst.* 2, 387.—A description of tests with the BaCl<sub>2</sub>-NaCl salt bath of the eutectic compn. Freedom from impurities is essential. Metallic Mn or ferro-Mn is most effective for desulfurization because of the decarburizing effect of the Fe compds.

W. A. MUDGE

Coarse-grained drop forgings. Their detection and correction. L. S. COPE. *Trans. Am. Soc. Steel Treating* 3, 808-23(1923).—Excessive high forging temps. and an insufficient amt. of mech. work are two chief contributing factors. Etching with a 40% HNO<sub>3</sub> soln. is a very satisfactory method for detg. coarse-grained forgings. Heat treatment of coarse-grained forgings is of little practical value, if insufficient mech. work has been done.

W. A. MUDGE

The formation of natural patina on copper surfaces. B. HAAS. *Metall* 1922, 131-32; *Chem. Zentr.* 1922, IV, 935.—Burnishing copper surfaces assists the deposition of patina but does not produce it. Dust-free air contg. H<sub>2</sub>O and CO<sub>2</sub> is necessary. Information is given on the production of a light brown burnishing suitable as a basis for patina.

C. C. DAVIS

Metal spraying by the Schoop process. SIDNEY MORNINGTON. *Compressed Air Mag.* 26, 10293-5(1921).—A historical survey is given.

H. G.

Automotive castings. H. B. SWAN. *Foundry* 51, 414-8(1923).—Data collected and compiled show variations in the constituents of metal used by different manufacturers. Total C content is governed by height of bed. Steel additions do not lower it.

V. O. HOMERBERG

The use of calorized metal in places subject to high temperatures. G. D. MANTLE. *Fuel & Furnaces* 1, No. 1, 25-8(1923).

D. F. BROWN

Static indentation tests. R. G. C. BATSON. *Engineering* 115, 534-7(1923).—The results are given of various investigations, which have been carried out with a view to elucidate various points in connection with the application of the indentation test as a measure of the hardness of materials. The points considered are, (1) investigation of law of comparison for ball indentation tests. (2) A comparison of the ball and cone methods of test. (3) The detn. of the relative hardness of very hard steels by means of ball hardness tests, in which the permanent deformation of the ball is taken as a measure of the hardness of the material producing it.

V. O. HOMERBERG

Relation between width of scratch and load on diamond in the scratch hardness test. G. A. HANKINS. *Engineering* 115, 537-40(1923).—The first method adopted was one by means of which the depth of scratch made by a diamond point on an inclined specimen was measured. The results show that the method can be utilized to obtain a measure of the hardness of metals on the same scale over a wide range, but at present the most useful applications appear to be in the case of the harder materials or where only small or valuable specimens are available. For general use, the adoption of a standard shape of diamond is advocated, since the results depend on the shape of the diamond. Small variations in the angles of different diamonds do not have a great effect on the results.

V. O. HOMERBERG

The mechanism and efficiency of restrainers. ANON. *Chem. Trade J.* 73, 34-5(1923).—Abstract from the Alkali Inspector's Rept. for 1922. Exptl. data show the comparative efficiencies of pickette acid, size (jelly), size (glue), tragon, gelatin, and

cresol acid as restrainers in the *pickling of tinplate*. The restraining effect is very similar in all except cresol acid, whose effect is nil. Size (glue) has the advantage that the soln. remains clear up to 90° and permits the use of weaker acid. W. H. BOYNTON

The use of steel molds as a substitute for cast-iron molds. FR. SCHVETZ. *Stahl u. Eisen* 42, 1897-1900(1922).—Expts. with 265 steel molds (0.35-0.45 C, 0.50-0.80 Mn, 0.60-0.90 P, 0.05-0.15 Si, and 0.04-0.06 S) gave an av. production of 235 three-ton ingots per mold, or an increase of 56% over cast-iron molds. One individual mold gave 327 ingots before cracking. Magnesite gave better results than chamotte for cores. No further data regarding mold manuf. or design are given. S. believes that proper pouring conditions and observance of the phys. properties of the steel will effect an economy in production and combat the prejudices against steel molds.

W. A. MUDGE

How iron rust grows. A. GRADENWITZ (reporting on experiments by ADLOPH ACKERMAN). *Brass World* 19, 123-4(1923).—Some Fe filings were spread out on a glass plate and a minute drop of dil. acid was applied; then the whole was covered with a glued cover glass and placed under a microscope for observation. At temps. between 12° and 17°, with max. effect at about 15°, phenomena occurred which were remarkably similar to some observed in org. nature. Flexible threads appeared and grew like org. fibers, shifting and moving under external stimuli (temp. variations). Also cell-like particles of Fe(OH)<sub>2</sub> were formed, which grew and subdivided like org. cells.

C. C. VAN VOORHIS

A new material for permanent magnets. E. GUMLICH. *Z. Elektrochem.* 44, 147-51; *Z. Physik* 14, 241-52(1923).—A study of magnetic properties of a series of Mn-C-Co steels varying in C from 0.6 to 1.4%, Mn from 3 to 1% and Co from 10 to 36%. In a second series 5-10% Cr was also added. It was found that there was no advantage in going above 4-5% Mn. For the Mn-C-Co series the best results in remanance, coercive force, and efficiency factor (remanance  $\times$  coercive force  $\times 10^{-3}$ ) with a field of  $H_{max} = 300$  was obtained with a compn. of C 0.83, Mn 4.8 and Co 35% hardened in ice-cold oil from 850°. The properties under such conditions were  $R = 9530$ ,  $K = 158$  and  $RK10^{-3} = 1505$ . The use of high magnetizing fields is important, as the properties increased up to  $H_{max} = 1100$ , the highest field tried. The addn. of Cr gave marked results, particularly with higher C content. Addn. of 5% Cr allowed a reduction of the expensive Co from 36 to 20%, with about the same magnetic results if the C is increased to 1.1 at the same time. The best magnetic results, however, were obtained by maintaining the Co at 36%, C 1.11%, Mn 4% and Cr 5% and quenching in ice-cold oil from 875°. In this case  $R = 9130$ ,  $K = 204$  and  $RK10^{-3} = 1863$ . If the field is increased to 1100  $H_{max}$  these values are further increased to  $R = 9310$ ,  $K = 227$  and  $RK10^{-3} = 2113$ . Aging and demagnetizing tests show the material to have a very high permeability factor.

W. E. RUDER

Metallographic study of methods employed in welding street car rail joints. E. JIMENO AND C. DEL FRIENSO. *Anales soc. españ. fis. quim.* 21, 181-6(1923).—In both thermite and electric arc welding segregation and crystallization take place for formation of a brittle zone (illustrated by photomicrographs). This is especially noticeable in the bottom parts of thermite welds because of the large amt. of metal melted. For practical purposes arc welding is superior.

L. E. GILSON

Forms of sulfur in coke and their relations to blast-furnace reactions (POWELL)

21. Coke quality and blast-furnace operations (SPERR, JACOBSON) 21.

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**Selective flotation of minerals.** G. A. BRAGG. Can. 232,606, July 10, 1923. The selective flotation of Pb and Zn sulfides is effected by subjecting a slightly alk. pulp of such minerals to a flotation operation in the presence of a small amt. of sol. sulfite.

**Concentration of ores by flotation.** G. E. SHERIDAN and G. G. GRISWOLD. Can. 232,518, July 10, 1923. Mixed sulfide ores of Pb and Zn or Fe are treated with a cyanide and an alk. salt (alk. carbonate) and subjected to a flotation operation to recover the Pb and reject the Zn or Fe. Cf. C. A. 16, 2838, 3625.

**Hydraulic ore separator.** A. E. BOOKWALTER. U. S. 1,461,647, July 10.

**Metallurgy of arsenical ores.** R. HADDAN. Brit. 190,025, Jan. 3, 1922. Arsenical ores and materials, more particularly arsenical Co and Ni ores, are chlorinated at 400–600° to remove As and Fe without volatilizing the chlorides of Co, Ni and Ag. AsCl<sub>3</sub> is sepd. from FeCl<sub>3</sub> by distn., and may then be hydrolyzed with 2–8 parts by wt. of H<sub>2</sub>O to yield a deposit of As<sub>2</sub>O<sub>3</sub> and a mother liquor contg. HCl and a small amt. of As in soln. The As may be recovered from the mother liquor by nearly neutralizing the soln. with CaCO<sub>3</sub> and then adding slaked lime to ppt. the As as Ca arsenite. Alternatively, the acid mother liquor may be used in the preliminary leaching of the ore, with care to avoid complete neutralization of the liquor. In a modification, the AsCl<sub>3</sub> is treated with hot H<sub>2</sub>O and Cl to form H<sub>3</sub>AsO<sub>4</sub>; the HCl gas evolved is dissolved in H<sub>2</sub>O and used in the preliminary extn. The solid residue delivered from the chlorination chamber, which may contain Co, Cu, Ni and Ag chlorides, is leached with about 8 parts of H<sub>2</sub>O and the dissolved chlorides are sepd. and recovered in any convenient way. The insol. residue is treated with Na thiosulfate or cyanide for the extn. of Ag, if present, and the final residue either discarded or dried and used for the diln. of unduly rich ore to control the chlorination temp. Alternatively, a smaller amt. of H<sub>2</sub>O may be used in the extn., so that Ag passes into soln. with the other chlorides and is afterwards pptd. by diln. The As and Fe may be removed separately by chlorination first at a temp. not exceeding 250°, whereby nearly all the As is volatilized, and then raising the temp. to volatilize the Fe. A suitable construction is specified.

**Extracting copper.** W. G. PERKINS. Brit. 190,246, Sept. 16, 1921. Cu ores such as porphyries contg. some non-oxidized Cu including CuS, with or without antimonides, arsenides, or P compd. of Cu, and with or without oxidized Cu compds., are oxidized by roasting at about 350–600° or even up to 700° so as to oxidize the non-oxidized compds.; the CuS is converted to sulfate or basic sulfate so far as possible, while any FeSO<sub>4</sub> formed is decomposed. The oxidized product is then reduced by heating in a reducing gas at 300–400° and leached with a soln. of NH<sub>3</sub> preferably contg. H<sub>2</sub>CO<sub>3</sub> with access of air, so as to dissolve the Cu. The Cu is recovered from the soln. by boiling off the NH<sub>3</sub>, a basic substance capable of yielding a sol. sulfate being added, if necessary, to decompose any sulfate present. The reduction and leaching may be effected as described in 185,242 (C. A. 17, 53). In an example, a South African Cu ore is roasted for 1 1/4 hr. at 400°, then for 2 1/4 hr. at 500°, and then for 1 1/2 hr. at 525°, the product being reduced in coal gas at 325–50°.

**Smelting ores.** W. E. TRENT. U. S. 1,461,372, July 10. Finely divided particles of fuel and Zn Fe sulfide or other ore are heated sufficiently to render them adhesive and are then projected upon a collecting surface to form a coherent mass preparatory to smelting. Cf. C. A. 16, 2838.

**Treating ores or other material with gas.** T. NAGEL. U. S. 1,459,923, June 26. In treating materials with a gas, e. g., in treating ore with a reducing gas, the material is passed through a helical passage countercurrentwise to the gas to insure intimate contact with the latter.

**Blast furnace.** E. L. IVES. U. S. 1,459,895, June 26. Plates of low-C steel contg. over 3% Mn are used for protecting the furnace at its stock line.

**Blast furnace.** J. KENNEDY. U. S. 1,460,065, June 26. Structural features of coolers adjacent an iron notch of the furnace.

**Blast furnace.** P. J. MORAN. U. S. 1,460,429, July 3.

**Vertical shaft furnace for direct production of steel.** C. DE THAL. U. S. 1,460,231, June 26.

**Furnace for purifying pig iron.** GYŌ KAWAMURA AND THE MITSUBISHI SEITETSU KABUSHIKI KAISHA. Japan. 41,512, Jan. 25, 1922. Near the bottom of a vertical fixed oven, there are 3 jetting tubes put in concentrically and fixed tangentially to the inner side wall, by which liquid fuel, hot air, and compressed air or superheated steam are injected. The contents are thus stirred without special agitating app. Melted pig iron, hematite as oxidizing agent, fluorspar and lime are introduced into the furnace, hot air at 5-8 lbs. per sq. in. and compressed air at 50-100 lbs., and heavy oil are injected. The product contains 3.403-3.510% C, 0.65-1.20% Si, 0.32-0.45% Mn, 0.009-0.021% P, and 0.006-0.013% S.

**Open-hearth furnaces.** G. L. DANFORTH, JR. Can. 232,432, July 3, 1923. An open-hearth furnace has regenerative chambers at each end, a slag pocket connected by passages to each regenerator, dampers controlling certain of the passages and other passages by-passing the dampers and connecting the regenerators with certain of the furnace ports. Cf. C. A. 17, 721.

**Open-hearth furnace.** G. L. DANFORTH, JR. Can. 232,434, July 3, 1923. An open-hearth furnace has a tubular water-cooled gas port, air uptakes located laterally of the gas port, air ports leading from the uptakes adjacent to the gas port, supplemental passages connecting the air passages with the furnace chamber and a combined air and gas mixing port located between the air and gas ports and the furnace chamber.

**Open-hearth furnace.** E. J. McDONNELL. Can. 232,435, July 3, 1923. An open-hearth furnace has an air port associated with a gas port and water cooling means in the walls of the gas and air port and adapted to maintain the area of the ports constant.

**Open-hearth furnace.** E. J. McDONNELL. Can. 232,436, July 3, 1923. An open-hearth furnace has an air uptake adjacent a gas port, an opening through the wall between the uptake and gas port whereby air may pass into the port and water-cooling means in the walls of the air opening.

**Open-hearth furnace.** G. L. DANFORTH, JR. Can. 232,608, July 10, 1923. A reversible furnace has a movable hood associated with the fuel uptake to form a forwardly extending port therefor, the hood adapted to slide through the end wall of the furnace and leave the uptakes unrestricted.

**Open-hearth furnace ports.** G. L. DANFORTH, JR. Can. 232,437, July 3, 1923. An open-hearth regenerative furnace has ports at each end with gas and air passages connected with the ports and a damper-controlled discharge port located above the ports. Cf. C. A. 17, 721.

**Open-hearth furnace ports.** G. L. DANFORTH, JR. Can. 232,438, July 3, 1923. A reversible regenerative furnace has fuel ports adjacent the side walls of the furnace, an air passage, an air port intermediate the fuel ports and passages connecting the air passage and fuel ports.

**Open-hearth furnace ports.** G. L. DANFORTH, JR. Can. 232,607, July 10, 1923. A reversible regenerative furnace has a fuel port located adjacent to each side wall of the furnace in each furnace end, the furnace side wall forming one wall of each such port, an air port located between the lateral gas ports and extending above them and a damper located centrally in each furnace and between the ports and furnace chamber.

**Furnace and port construction.** G. L. DANFORTH, JR. Can. 232,612, July 10, 1923. An open-hearth regenerative furnace has a combined air and fuel port, an air passage communicating with the furnace chamber, a supplemental passage connecting the air passage and the port and a damper adapted selectively to close off communication between the air passage and furnace chamber.

**Metallurgical furnace.** G. L. DANFORTH, JR. Can. 232,609, July 10, 1923. A reversible regenerative furnace having a gas passage at each end and an air passage associated with each gas passage has supplemental passages located laterally of the gas passages adapted to carry off the products of combustion.

**Metallurgical furnace.** G. L. DANFORTH, JR. Can. 232,433, July 3, 1923. An open-hearth furnace has combined ports for incoming air and fuel, a fuel uptake leading to each combined port, ports for the products of combustion leading to the downtakes located laterally of the fuel uptake, an air uptake entering the combined port, and passages connecting the air uptake to the downtake passages.

**Metallurgical furnace and port construction.** G. L. DANFORTH, JR. Can. 232,611, July 10, 1923. A regenerative furnace has a pair of spaced air uptakes at each end, a combined air and fuel port located between the uptakes, the uptakes being connected to the ports, passages connecting the uptakes to the furnace chamber and dampers controlling the passages.

**Regenerative furnace.** G. L. DANFORTH, JR. Can. 232,610, July 10, 1923. A regenerative furnace has uptakes at the ends connecting the regenerators and furnace

chamber, ports in the furnace ends and supplementary passages connecting the uptakes and ports.

**Reversing valves for open-hearth furnace.** WM. H. WHARTON. Can. 232,796, July 17, 1923.

**Air control for furnaces.** G. L. DANFORTH, JR. Can. 232,431, July 3, 1923. An open-hearth regenerative furnace has passages entering the furnace ends and means adapted to introduce an auxiliary fluid flow into the passages in a direction away from the furnace.

**Iron and steel manufacture; furnaces.** G. CONSTANT and A. BRUZAC. Brit. 191,032, Dec. 22, 1922. Addn. to 179,532 (C. A. 16, 3302). In a process for the production of Fe and steel as described in the principal patent, reducing gases from a generator or the smelting furnace are passed through the dried ore, sepd. from its gang, contained in 1 or more reduction chambers arranged above or in proximity to the smelting furnace, the ore being reduced and then allowed to fall or pass into the furnace without access of air. A suitable construction is specified.

**Basic steel.** R. BAURET. U. S. 1,459,712, June 26. In producing basic steel in a converter from gray pig Fe with a Si content above the normal, a liquid bath comprising oxides and lime is prepd. in the converter before adding the Fe, immediately to oxidize the Si in the Fe. After adding the Fe, the charge is blown with air to complete conversion.

**Pickling bath for iron.** O. VOGEL. U. S. 1,460,395, July 3. A pickling bath for Fe is formed of  $H_2SO_4$  or other acid soln. contg. about 1% quinoline or one of its derivs. to prevent the metal from becoming brittle.

**Coating for metals.** A. DUKE. U. S. 1,460,317, June 26. A mixt. for coating steam boilers or pipes or other metal surfaces is formed of lard oil 25, lubricating oil 25, white lead 25, graphite 15, powd. borax 5 and lamp black 5 parts.

**Coated ferrous metal.** W. B. BALLANTINE. U. S. 1,460,049, June 26. Workable metal articles such as rods or tubes are formed with a core of a corrodible ferrous metal, *e. g.*, ordinary steel, with an overlying layer of non-corrodible Fe alloy, *e. g.*, "rustless" chrome steel.

**Removing rust from metals.** J. S. GRAVELY. U. S. 1,459,910, June 26. Rust is removed from articles of ferrous metal or Ni-plated ware by treating them with a soln. of  $NH_4$  citrate or other org.  $NH_4$  salt, and then, after a lapse of time, washing off the slime produced.

**Alloys.** A. PACZ. Can. 232,935, July 24, 1923. A hardening metal with which is intimately mixed a material acid with respect to the oxide of the metal is added to a molten alloy. *E. g.*, W intimately mixed with  $SiO_2$  in powder or briquet form is added to molten steel.

**Alloys.** R. S. ARCHER and Z. JEFFRIES. Brit. 190,721, Dec. 20, 1922. Al alloys contain not less than about 3.5% of Cu, with or without other elements such as Mn, Cr, Si and Zn, Mg being absent except as an impurity. A preferred compn. is about 4.5% of Cu, 0.75% of Mn and 0.75% of Si. The alloys are maintained at 500-90° for some time, and are either quenched outright and subsequently aged by being heated at 100-200° for some time or are quenched only to the temp. at which they are to be aged. Al alloys contg. (1) Cu 3.95, Fe 1.22%, and Si 0.31 and (2) Cu 3.98, Ca 0.54, and Si 0.29, are also referred to.

**Alloys.** R. S. ARCHER and Z. JEFFRIES. Brit. 190,722, Dec. 20, 1922. Al alloys contain Mg and not less than about 0.5% of Si, with or without other elements such as Ni, Mn and Cr, Cu being absent except as an impurity. The alloys preferably contain about 1% each of Mg and Si. The alloys are maintained at 500-80° for some time, and are either quenched outright and subsequently aged by being heated at 100-200° for some time, or are quenched only to the temp. at which they are to be aged.

**Alloys.** R. S. ARCHER and Z. JEFFRIES. Brit. 191,024, Dec. 20, 1922. Al alloys contain Cu, Mg, and not less than 0.5% of Si, with or without other elements such as Mn, Cr, Ni, and Mo. A preferred compn. is about 4.5% of Cu, 0.5% of Mg, 0.75% of Si, and 0.5% of Mn. The alloys are maintained at 500-50° for some time, and are either quenched outright and subsequently aged by being heated at 100-75° for some time, or are quenched only to the temp. at which they are to be aged.

**Alloys.** A. GREYER. Brit. 190,996, Aug. 29, 1922. An Al alloy contg. Cu, Mn, Mg, Pb, and C is made by incorporating finely powd. C with part of the Al in a molten state, adding a previously prepd. mixt. of Cu and Mn, then the remaining Al, and finally the Pb and Mg, the operation being carried out in a covered crucible and oxidation being prevented by means of a layer of broken charcoal. Traces of Si and Fe may also be present.

**Nickel-aluminium-silicon alloy.** H. S. COOPER. U. S. 1,461,178, July 10. An alloy adapted for the manuf. of machine parts or other polished articles is formed of Ni 82-6, Al 6-12 and Si 5-8%. The alloy has a hardness of about 60 or higher. W or Mo also may be added.

**Magnesium-silicon-manganese alloy.** F. M. BRACKETT. U. S. 1,461,643, July 10. An alloy suitable for treating Fe or steel is formed of Mg 4.3-31, Si 32-45, Mn 22.7-52.3, Fe 2.5-27 and C 0.03-0.30 parts.

**Metals or alloys poor in carbon and silicon.** B. M. S. KALLING and S. D. DANIELI. Can. 232,741, July 17, 1923. An alloy rich in Si is mixed with an agent capable of oxidizing Si and the mixt. is heated in an elec. furnace in which the effective ohmic voltage drop between the electrode and charge is above 70.

**Permanent magnets; alloys.** S. WATANABE. Brit. 189,924, Oct. 5, 1921. A self-hardening steel alloy for permanent magnets contains Cr 1-5, Mn 1-3, and C 0.5-1%, with or without the addn. of one or more of the following elements: W, Co, Mo, V, Si, Cu, Ni, Al, U, Zr, B. The magnet may be artificially aged by heating it to 100° for 30 min.

**Purifying molten metal.** H. G. C. THOFERN. U. S. 1,460,830, July 3. Molten steel, Cu or other metal while being poured into a ladle is scavenged with an alloy formed of Al and Mg.

**Electrical heating material (alloy).** P. A. E. ARMSTRONG and R. P. DEVRIS. U. S. 1,460,048, June 26. Elec. heating elements adapted for use in direct contact with liquids to be heated are formed of an alloy steel contg. C 0.05-1.0, Cr 10-30, Si 2-6% and small amts. of W and Mn. The alloy may be worked either hot or cold.

**Metal tubes.** P. A. E. ARMSTRONG. U. S. 1,461,018, July 10. An ingot of steel or other metal is cast around a core of magnesite, talc or other suitable material and after the ingot has undergone elongation and reduction of cross-section, *e. g.*, by rolling to form a hollow drill rod, the core material is removed.

**Bearings.** COMPAGNIE D'APPLICATIONS MÉCANIQUES. Brit. 190,122, Nov. 13, 1922. Ball or roller bearings of washing, bleaching dyeing, or like machinery, which operate in an acid medium, are made of non-oxidizable material. The balls or rollers are made of harder substances than the race rings to prevent deformation of the former. Suitable materials are bronze and its alloys, particularly Al bronze, for the race rings, and glass, agate, porcelain, artificial ruby, etc., for the balls or rollers.

**Mending composition.** C. A. WRIGHT. Can. 232,583, July 10, 1923. A compn. for mending cracks in cast-iron or other metal vessels contains Al 5-10% and S 90-5% combined at a temp. not exceeding 250° F.

**Welding composition.** J. R. CAMPBELL and J. L. REYNOLDS. U. S. 1,460,476, July 3. A compn. for use in welding steel or Fe is formed of Fe oxide 5-10, MnO<sub>2</sub> 15-30 and borax 80-60 parts.

**Welding rod.** J. H. CRITCHETT. U. S. 1,460,790, July 3. A rod for welding is formed of an Fe alloy contg. C 0.5% and Cr 1.1%.

## 10—ORGANIC CHEMISTRY

CHAS. A. ROULLER and CLARENCE J. WEST

**Recent advances in science—organic chemistry.** O. L. BRADY. *Science Progress* 17, 545-52 (1923).—Review of recent work on the structure of benzene and on optically active diazo compds.

JOSEPH S. HEPBURN

**Theory of variable affinity and its applications in organic chemistry.** I. A. ORSKHOFF. *Rev. gén. sci.* 34, 264-70 (1923).—The classic theory of constitution of org. compds., founded by Kekulé, has been and still is useful, but leaves many questions unanswered. Examples are given and the work of Claus and of Werner is reviewed. W. represents the C atom as spherical, united to 4 other equal atoms (supposed also spherical), each of the 4 neutralizing affinity of the C atom radiating from its surface and equal to its own. He calls the at. surfaces (evidently spherical segments), "surfaces of union." By W.'s theory in the system R<sub>4</sub>CCR<sub>3</sub>, the 2 spherical atoms use in uniting the residual at. surface left free by the 6 other atoms. The "surfaces of union" will be represented by spherical segments. If the R atoms absorb much affinity (large "surfaces of union"), that of the two C atoms will be that much smaller and conversely, conceivably approaching zero. The quantities of affinity exchanged between atoms may thus vary within wide limits. For this, the characteristic and fundamental point of this theory, differentiating it from the classical conception, O. proposes the name

"theory of variable affinity," for the quantity of affinity between two atoms the term "affinity capacity" of an atom or radical, free from the hypothetical and geometrical character of the "surface of union." W.'s at. model raises the question: can the transferable affinity of the two C atoms be utilized entirely or not? Geometrical consideration of affinity acting normally to the surface gives a negative answer. For a simple "normal" union (where the "surfaces of union" of the 4 atoms are equal) the free affinity is about  $1/2-1/4$  the combined. The relation varies as the relative size of the "surfaces of union." From this reasoning follows an important consequence of W.'s fundamental idea: each union between atoms leaves always a residue of unused affinity. It is concluded that all union leaves always a residue of free affinity. Further, as the affinity of a simple union may vary within wide limits, the free affinity may also. The parts of the mol. presenting most free affinity are subject to attack of reagents. The theory of variable affinity will not be applied to stereochem. or aromatic nuclei, but to the study of the constitution and chem. properties of compds. O. has concluded from this theory that the affinity exchanged between a C atom and the other atoms tied to it is variable, while the total affinity at the disposal of the atom is const. An important conclusion is that a C atom using much affinity for union with another atom will be poor in affinity available for union with still other atoms; their union will be weak; the enforcement of a union at one point of the mol. causes a proportionate weakening of adjacent unions and *vice versa*. E. g., introduction of a radical R with large affinity capacity into a chain of C atoms,  $^2\text{C}-^2\text{C}-^1\text{C}-^4\text{C}-^6\text{C}$ , causes weakening of available affinity in C atom 1, to which it is tied; its unions with C atoms 2 and 4 will be weakened; C atoms 2 and 4 having dispensed little affinity will possess more to tie C atoms 3 and 5 strongly, etc. The distribution of affinities in the chain will be periodic, according to the scheme  $^4\text{C}-^2\text{C}-^1\text{C}-^4\text{C}-^6\text{C}$ . As, besides, chem. properties ought to depend upon the relative strength of the unions and the distribution of energy in the mol., we expect to find periodic oscillations of comparable chem. properties in homologous series. Variability of unions and periodic change of properties are the two fundamental conclusions of the theory of variable affinity, which will be discussed in the second paper of this series, to apply the ideas here developed to various problems of org. chemistry.

JAMES BROWN

**Oxidation of aliphatic hydrocarbons with nitrogen peroxide. II.** CH. GRÄNACHER AND P. SCHAUFELBERGER. *Helvetica Chim. Acta* 5, 392-5(1922); cf. C. A. 15, 668.—The oxidation mixt., prep'd. by passing  $\text{NO}_2$  into paraffin at  $120-30^\circ$  for 30 hrs. was 1st heated several hrs. with NaOH to decomp. anhydrides and lactones, the Na soaps were transformed into the Ba salts to remove neutral products, the free acids liberated and esterified. The esters  $b_p$  37-240° and 240-300°; the 2nd solidified and m. 40-5°, and gave an acid,  $\text{C}_{20}\text{H}_{40}\text{O}_2$ , m. 59-60°. The 1st fraction was not investigated. In a 2nd expt., were obtained Et esters,  $b_p$  90-135° and 135-55°. The 1st fraction analyzed for  $\text{C}_{14}\text{H}_{28}\text{O}_2$ , the 2nd for  $\text{C}_{14}\text{H}_{28}\text{O}_2$  after crystn. of the Li salt. C. J. WEXST

**Transformations in unsaturated compounds. Negative migration. A new theory of the conjugated system C:C:C:C.** ALFRED GILLET. *Bull. soc. chim. Belg.* 31, 365-75 (1922); cf. C. A. 16, 2107, 2306, 2307.—A theoretical discussion in which G. maintains that by generalizing 2 or 3 types of transformation of which several cases are known, the properties of conjugated double bonds may be explained without assuming the existence of partial valencies. J. C. S.

**Chlorination of methane.** ARTHUR SCHLEEDT AND CURT LUCKOW. *Ber.* 55B, 3710-26(1922).—The chlorination of  $\text{CH}_4$  has been studied by passing a mixt. of the gases through electrically heated glass or quartz tubes. When the gases are used in mol. proportions, inflammation occurs, but the flame gradually dies out; it is permanent when an excess of Cl is used. If an excess of  $\text{CH}_4$  is used, ignition is not observed but the Cl is only quant. utilized if the temp. is below a certain min. depending on the precise compn. of the mixt. and its rate of flow. The phenomena are not greatly affected by the presence of catalysts or by an increase of temp. of  $100^\circ$  above the min. The reaction products are freed of HCl by passage through warm concd. KOH ( $\text{H}_2\text{O}$  dissolves some of the MeCl) and subsequently condensed at a temp. not exceeding  $-110^\circ$ . Vapor pressures are reported (curves) for MeCl below  $-30^\circ$ , for  $\text{CH}_2\text{Cl}_2$  and  $\text{CHCl}_3$  below  $0^\circ$  and for  $\text{CCl}_4$  below  $-20^\circ$ . MeCl can be sep'd. from the reaction product by Stock's method of fractional distn., but the other products are estimated approx. by the technical distn. method. When the velocity of passage of the gases per unit of surface exceeds a certain value and a large increase of heating (catalyzing) surface is not also provided, the reaction tends more and more towards a steady ignition and increased formation of higher products is observed, which takes place particularly at the expense of the  $\text{CHCl}_3$ . The greater the velocity of the gas, the greater must be the cata-

lyzing surface. If the rate of flow is below the ignition value higher products are not formed in appreciable amts., but the relative proportions of the chlorinated methanes are not those which would be expected from a step-wise reaction. Under these conditions marked changes in the production of  $\text{CCl}_4$  and higher products are only observed when the catalyzing surface is enormously increased (e. g., by the use of activated charcoal). This result is not appreciably modified when the min. temp. is exceeded by as much as  $100^\circ$ , when the heating zone is increased or diminished or when catalysts, such as  $\text{FeCl}_3$ ,  $\text{MoCl}_5$  or  $\text{SbCl}_5$ , are present. On the other hand, the results obtained are not in harmony with the values calcd. from Martin's formula (*C. A.* 15, 2375). If the rate of flow is considerably below the ignition value an increased production of  $\text{CHCl}_3$  or  $\text{CCl}_4$  or substances of similar b. p. at the expense of the  $\text{MeCl}$  and  $\text{CH}_3\text{Cl}$  is observed. The causes which produce results differing so greatly from those of a step-wise reaction are discussed in detail. The most probable are the dissociation of  $\text{CH}_4$  and subsequent changes such as:  $\text{MeCl} + \text{CH}_4 = \text{C}_2\text{H}_6 + \text{HCl}$ ;  $\text{CH}_3\text{Cl} + \text{CH}_4 = \text{MeCH}_2\text{Cl} + \text{HCl}$ ;  $2\text{MeCl} = \text{MeCH}_2\text{Cl} + \text{HCl}$ ;  $\text{CH}_3\text{Cl} + \text{MeCl} = \text{CH}_2\text{ClCH}_2\text{Cl}$  (or  $\text{MeCHCl}_2$ ) +  $\text{HCl}$ . In the prepn. of  $\text{MeCl}$  from  $\text{CH}_4$  and  $\text{COCl}_2$ , the action appears to be due to greatly dil.  $\text{Cl}$ .

C. J. WESS

**Oxonium compounds in the vapor state. Methyl ether-hydrogen chloride.** O. MAASS AND D. M. MORRISON. *J. Am. Chem. Soc.* 45, 1675-82 (1923).—From the data obtained on studying mixts. of  $\text{Me}_2\text{O}$  and  $\text{HCl}$  the amt. associated to form the oxonium compd.,  $\text{Me}_2\text{OHCl}$ , has been calcd. The similarity between  $\text{Me}_2\text{OHCl}$  and  $\text{NH}_4\text{Cl}$  is pointed out and the formations of the former attributed to induced polarity in the  $\text{Me}_2\text{O}$  mol. caused by the polar  $\text{HCl}$  mol.

H. JERMAIN CRIGHTON

**Action of organomagnesium compounds on nitriles. *n*-Butyronitrile.** F. BAERTS. *Bull. soc. chim. Belg.* 31, 421-6 (1922).—The results obtained with  $\text{PrCN}$  are exactly parallel to those previously obtained by B. with  $\text{EtCN}$  (*C. A.* 17, 1426). The chief product of  $\text{PrCN}$  and  $\text{EtMgBr}$  was  $\text{EtCOPr}$  (about 40%).  $\text{PrC}_2\text{EtOH}$  was also formed together with termol. cyanopropane,  $(\text{PrCN})_2$ , and a substance not previously isolated which proved to be *α*-butyrylbutyronitrile, a liquid, b.  $216^\circ$ , semicarbazone, m.  $88-90^\circ$ .

J. C. S.

**Photosynthesis of amines.** O. W. SNOW AND J. F. S. STONE. *J. Chem. Soc.* 123, 1509-15 (1923); cf. Baly, Heilbron and Stern, *C. A.* 17, 1421.—The supposed synthesis of various *N* derivs. by B., H. and S. may have been due to the normal interaction of  $\text{NH}_4\text{Cl}$  and  $\text{HCHO}$  (cf. Werner, *C. A.* 11, 3243). The tests employed for identifying these compds. will not distinguish them from the products of the normal reaction, which is true of either the chem. or physiol. tests. While they have neither confirmed nor disproved the formation of the products claimed by B., H. and S., S. and S. believe the evidence advanced in support of the photosynthesis of the substances is insufficient.

C. J. WESS

**A bismuth cacodylate.** P. CLAUSMANN. *Bull. soc. chim.* 33, 447-8 (1923).—A strong soln. of cacodylic acid satd. hot with  $\text{Bi}_2\text{O}_3$ , deposits on cooling a *Bi* salt ( $\text{Me}_2\text{AsO}_2$ ),  $\text{Bi}_2.8\text{H}_2\text{O}$ , m.  $82^\circ$ , 21% sol. in  $\text{H}_2\text{O}$  at  $12^\circ$ , readily sol. in alc. and glycerol. The salt is easily hydrolyzed, but a clear soln. can be obtained when  $\text{CO}_2$  is absent.

BEN H. NICOLET

**Review of the organic mercury compounds.** J. JÜRGENS. *Chem. Weekblad* 18, 627-30, 641-3 (1921).—The literature on the chemistry and the physiol. action of org. Hg compds. for the past 20 yrs. is reviewed.

R. BEUTNER

**Action of carbon disulfide on mercuric acetate.** A. BERNARDI AND G. ROSSI. *Gazz. chim. ital.* 53, 225-8 (1923).—In a previous paper (*C. A.* 16, 2113) B. and R. described  $\text{S}(\text{HgOAc})_2$  (I) obtained from  $\text{CS}_2$  and  $\text{Hg}(\text{OAc})_2$ . Later Molati (*C. A.* 17, 1425) stated that the same compd. (II) had been previously obtained by Borelli (*C. A.* 5, 1716-17) and was described in Beilstein and Gmelin-Kraut. B. and R. have repeated the prepn. of both of these compds. and have compared their properties in detail: I decomps.  $210-5^\circ$  without blackening and gives no  $\text{HgS}$ , while II remains unchanged up to  $232^\circ$  and then decomps. within  $2^\circ$ , giving  $\text{HgS} + \text{Hg}(\text{OAc})_2$ . I decomps. very slowly in  $\text{H}_2\text{O}$  on the boiling  $\text{H}_2\text{O}$  bath, while II decomps. at  $40^\circ$ , giving  $\text{HgS}$ , and at the boiling temp. is entirely decompd. For other details see the original.

E. J. WITZEMANN

**Influence of temperature on two alternative modes of decomposition of formic acid.** C. N. HINSHELWOOD AND HAROLD HARTLEY. *J. Chem. Soc.* 123, 1333-8 (1923); cf. *C. A.* 17, 914.—The catalytic activity of different glasses on the decompn. of  $\text{HCO}_2\text{H}$  may differ markedly but the same influence of temp. on the relative rates of the two reaction ( $\text{CO}_2$  and  $\text{H}_2$ ,  $\text{CO}$  and  $\text{H}_2\text{O}$ ) is found. The temp. range studied has been extended to cover  $138^\circ$  to  $350^\circ$ . The values of the heat of activation calcd. from the



curves are:  $E_{00}$  12,000 cal. approx.;  $E_{00}$  24,500 cal. approx. In the original series (covering  $240^\circ$  to  $300^\circ$ ) the values found were 16,000 and 28,000 cal., so that the same relation between the 2 is preserved. Deta. of the %  $\text{CO}_2$  in the decompn. products at successive intervals indicates that the mode of decompn. of the adsorbed  $\text{HCO}_2\text{H}$  is conditioned by independent probabilities and not detd. to any appreciable extent by the equil.  $\text{H}_2\text{O} + \text{CO} \rightleftharpoons \text{HCO}_2\text{H}$  and  $\text{H}_2 + \text{CO}_2 \rightleftharpoons \text{HCO}_2\text{H}$ . There is no indication from velocity measurements that the products of the reaction yielding CO exert any retarding effect. Some accelerating influence of excess of  $\text{H}_2\text{O}$  on the velocity of the  $\text{CO}_2$  reaction has been observed.

C. J. WEST

**$\alpha$ -Oxalyl derivatives of  $\beta,\beta$ - and  $\alpha,\beta$ -dimethylacrylic acids.** LUCY HIGGINBOTHAM AND ARTHUR LAPWORTH. *J. Chem. Soc.* 123, 1325-32 (1923).—Condensations of the type  $(\text{CO}_2\text{Et})_2 + \text{MeCH}:\text{CHCO}_2\text{Et} + \text{EtONa} = \text{EtO}_2\text{CC}(\text{ONa}):\text{CHCH}:\text{CHCO}_2\text{Et} + 2\text{EtOH}$  are specially interesting in relation to the question of induced latent polarities of atoms in C chains and the 1st work (*J. Chem. Soc.* 79, 1276) has been extended to the di-Me derivs. The condensation products from the  $\alpha,\beta$ -deriv. are secured for the most part as the  $\gamma$ -oxalyl deriv., while those of the  $\beta,\beta$ -deriv. are converted into a pyrone compd. The true oxalyl deriv. is obtained as the free acid by converting the ester into the corresponding acid and opening the pyrone ring with excess of alkali. Addn. of a mixt. of  $(\text{CO}_2\text{Et})_2$  and  $\text{Me}_2\text{C}:\text{CHCO}_2\text{Et}$  to finely divided EtOK in  $\text{Et}_2\text{O}$  at  $0^\circ$  gives 4-methyl- $\alpha$ -pyrone-6-carboxylic acid, (I) partly fuses at  $97-100^\circ$  (it contains  $11\frac{1}{2}\%$  of crystn.), liquefies  $189^\circ$  and after cooling, m.  $194^\circ$ . The alk. soln. is bright yellow. Warmed 2 hrs. on the  $\text{H}_2\text{O}$  bath with excess 10% NaOH, an acid (3,5-dimethylbenzene-1,2,4-tricarboxylic acid?), m.  $220^\circ$ , is obtained. *Et ester* of I, m.  $68^\circ$ . It does not yield the ordinary CO derivs.  $\gamma$ -Oxalyl- $\beta,\beta$ -dimethylacrylic acid ( $\delta$ -hydroxy- $\beta$ -methylmuconic acid),  $\text{HO}_2\text{CC}(\text{OH}):\text{CHMe}:\text{CHCO}_2\text{H}$ , yellow, m.  $162-3^\circ$ , results by dissolving I in cold 30% NaOH and, after 1.5 hrs., adding excess of cold concd. HCl.  $\text{FeCl}_3$  gives an intense greenish black color, while with I or its ester no color is produced. Heating with HCl or AcOH reconverts it into I. A method of prepn. for  $\text{MeCH}:\text{CMeCO}_2\text{Et}$  is given. Condensation with  $(\text{CO}_2\text{Et})_2$  by EtOK gives *Et*  $\gamma$ -oxalyl- $\alpha,\beta$ -dimethylacrylate (II), m.  $91-2^\circ$ .  $\text{FeCl}_3$  gives a deep black color, alkalis yellow solns., from which the K deriv. seps. as bright yellow needles. The free acid ( $\delta$ -hydroxy- $\alpha$ -methylmuconic acid) m.  $226^\circ$  (decompn.), may be prepd. from II but better from III by heating with excess of 5% aq. NaOH for 0.5 hr.;  $\text{FeCl}_3$  gives a deep black color. The Na salt is yellow. 3-Methyl- $\alpha$ -pyrone-6-carboxylic acid (III), m.  $246-7^\circ$ , by heating II with excess of HCl until in soln. and evap. to dryness on the  $\text{H}_2\text{O}$  bath.  $\text{FeCl}_3$  gives no color reaction. *Et ester*, m.  $116^\circ$ .

C. J. WEST

**Spectrochemistry of compounds with accumulated conjugation.** K. v. AUWERS. *J. prakt. Chem.* 105, 361-84 (1923); cf. C. A. 5, 670; 6, 72.—It was earlier shown that compds. with "crossed" conjugate bonds show much smaller exaltation than those containing "accumulated" conjugated bonds. In order to establish this principle the following study was made. (WITTE H. WESTERMANN).  $\text{CH}_2:\text{CHCH}_2\text{CH}(\text{OH})\text{CH}:\text{CHMe}$ ,  $b_{15}$   $61-2^\circ$ ,  $d_4^{20}$  0.8612,  $n_D$  1.45089,  $n_H$  1.45414,  $n_F$  1.46191,  $n_T$  1.46840 at  $20^\circ$ .  $\text{H}_2\text{O}$  is split off by heating with  $\text{K}_2\text{SO}_4$  and distn. in an atm. of  $\text{CO}_2$ .  $\text{CH}_2:\text{CHCH}:\text{C}:\text{CHMe}$ , b.  $113-4^\circ$ ,  $d_4^{20}$  0.764,  $n_D$  1.50786,  $n_H$  1.51604,  $n_F$  1.53754,  $n_T$  1.55742 at  $19.8^\circ$ ;  $E_{25}$  4.09,  $E_{28}$  4.36,  $E_{28}-E_{25}$  118%,  $E_{27}-E_{28}$  130% (this order will be used in all other compds. described). These results confirm the view that the sp. exaltation for hexatriene given by Perkin Sr. is too small. (WITTE J. HEYNA). *Et*  $\beta$ -vinylacrylate,  $b_{15}$   $57.2-7.5^\circ$ ,  $b_{18}$   $59.9^\circ$ ,  $b_{21}$   $70-1^\circ$ ,  $d_4^{20}$  0.9348,  $n_D$  1.46948, 1.47504, 1.48928, 1.50252, 2.07, 2.19, 81%, 92%.  $\text{MeCH}:\text{CHCH}:\text{CHCO}_2\text{Et}$ ,  $b_{15}$   $76.5^\circ$ ,  $b_{18}$   $81^\circ$ ,  $d_4^{25}$  0.9405,  $n_D$  1.49149, 1.49775, 1.51395, —, 2.56, 2.71, 103%, 119%. *Et*  $\alpha$ -methylsorbinate,  $d_4^{16.5}$  0.9501,  $d_4^{20}$  0.947,  $n_D$  1.49306, 1.49907, 1.51494, 1.52998, 1.90, 2.04, 99%, 110%. *Et*  $\alpha$ -ethylsorbinate,  $d_4^{15.3}$  0.9345,  $d_4^{20}$  0.931,  $n_D$  1.49076, 1.49653, 1.51162, 1.52605, 1.95, 2.08, 94%, 107%. *Et*  $\gamma$ -methylsorbinate,  $d_4^{15.6}$  0.9499,  $d_4^{20}$  0.946,  $n_D$  1.49484, 1.500087, 1.51642, 1.53138, 2.01, 2.15, 96%, 107%. *Et*  $\beta,\beta$ -dimethylsorbinate,  $d_4^{18.6}$  0.9343,  $d_4^{20}$  0.933,  $n_D$  1.48301, 1.48823, 1.50175, 1.51447, 1.54, 1.65, 76%, 84%. *Di-Et crotonylidenemalonate*,  $b_{15}$   $149^\circ$ ,  $d_4^{14.3}$  1.0508,  $d_4^{20}$  1.045,  $n_D$  1.47867, 1.48353, 1.49629, —, 1.04, 1.12, 71%, —.  $\text{MeCH}:\text{CHCH}:\text{CHCOCi}$ ,  $d_4^{18.75}$  1.0066,  $d_4^{20}$  1.0065,  $n_D$  1.54707, 1.55710, 1.58453, —, 3.69, 3.97, 182%, —.  $\text{PhCH}:\text{CHCH}:\text{CHCO}_2\text{Et}$  (stable form), m.  $25-6^\circ$ ,  $d_4^{12.2}$  1.0294,  $d_4^{20}$  1.049,  $n_D$  1.60039, 1.61348, 1.65080, 1.69311 at  $42.2^\circ$ , 4.09, 4.46, 222%, 262%. The *allo* ester decomp. at 10 mm.,  $d_4^{18.8}$  1.0473,  $d_4^{20}$  1.044,  $n_D$  1.60645, 1.61950, 1.65722, 1.70002 at  $16.8^\circ$ , 3.84, 4.19, 216%, 258%.

PhCH:CHCH:CMcCO<sub>2</sub>Et,  $d_{44}^{22}$  1.0391,  $d_4^{20}$  1.041,  $n$  1.60324, 1.61641, 1.65401, — at 22° (in a 2nd sample  $n_D$  1.69588), 3.62, 3.98, 222%, 266%. PhCH:CHCMe:CHCO<sub>2</sub>Et,  $d_{44}^{25.1}$  1.0384,  $d_4^{20}$  1.043,  $n$  1.58849, 1.59936, 1.63013, 1.66379 at 25.1°, 3.03, 3.30, 171%, 202%.  $\gamma$ -Methylcinnamylideneacetic acid, m. 108–10°, results from PhCH:CMcCHO, CH<sub>2</sub>(CO<sub>2</sub>H)<sub>2</sub> and C<sub>6</sub>H<sub>5</sub>N or better from PhCH:CMcCHO, BrCHCO<sub>2</sub>Et and Zn in C<sub>6</sub>H<sub>6</sub> and sapon. of the ester; *Et ester*,  $d_4^{20.3}$  1.0387,  $d_4^{20}$  1.039,  $n$  1.59010, 1.60100, 1.63178, 1.66561 at 20.3°, 3.10, 3.38, 171%, 201%. AcCH:CHCO<sub>2</sub>Et,  $d_4^{18.1}$  1.0387,  $d_4^{20}$  1.037,  $n$  1.44987, 1.45346, 1.46250, 1.47081 at 18.1°, 0.87, 0.90, 33%, 39%. (—CH:CHCO<sub>2</sub>Et)<sub>2</sub>,  $d_4^{29.1}$  0.9829,  $n$  1.46178, 1.46755, 1.48259, 1.49695 at 99.1°, 2.49, 2.64, 117%, 128%. EtO<sub>2</sub>CCH:CMcCH:CHCO<sub>2</sub>Et,  $d_4^{24.8}$  1.1006,  $d_4^{20}$  1.115,  $n$  1.50142, 1.50762, 1.52413, 1.53993 at 34.9°, 1.87, 2.00, 105%, 118%. *Di-Et isoprenedicarboxylate*, b<sub>15</sub> 163–4°,  $d_4^{17}$  1.0586,  $d_4^{20}$  1.056,  $n$  1.49515, 1.50081, 1.51560, 1.52984 at 17°, 1.64, 1.76, 96%, 107%.

C. J. WEST

**Constitution of allyl cyanide.** P. BRUYLANTS. *Bull. acad. roy. Belg.* 1920, 479–86. —Pyridine and  $\gamma$ -chlorobutyronitrile heated together give allyl cyanide, b<sub>17</sub> 114–16°,  $d_4^{20}$  0.8318,  $n_D^{20}$  1.41438. The product is not accompanied by the nitrile of cyclopropanecarboxylic acid, which, however, is formed by the action of dry KOH on the above Cl compd., while the latter with NaOEt affords a mixt. of the cyclic nitrile and  $\gamma$ -ethoxybutyronitrile. By the removal of the elements of water from  $\alpha$ -hydroxybutyronitrile, a product (b<sub>14</sub> 115–16°,  $n_D^{20}$  1.41692) is obtained, which, from its convertibility into two known dibromoamides is thought to be a mixt. of crotononitrile and isocrotononitrile. KCN and allyl bromide interact to give the same mixt. J. C. S.

**The nitriles of fluoro- and difluoroacetic acids.** FRED SWARTS. *Bull. soc. chim. Belg.* 31, 364–5 (1922).—These substances were prepd. by distn. of the corresponding amides with P<sub>2</sub>O<sub>5</sub>. *Fluoroacetonitrile* is a liquid of penetrating odor, b. 81.8–82°,  $d_4^{18}$  1.0730, slightly sol. in water and reacts rapidly with KOH. *Difluoroacetonitrile*, b. 22.8–23.4°, is a colorless, mobile liquid,  $d_4^{14.5}$  1.1130, very sparingly sol. in water and reacting vigorously with KOH. A specimen kept for several years did not undergo polymerization. J. C. S.

**$\alpha$ -Sulfolutyrinic acid and its optically active components.** H. J. BACKER AND J. H. DE BOER. *Proc. Acad. Sci. Amsterdam* 26, 79–82 (1923).— $\alpha$ -Sulfolutyrinic acid, m. 66°, results by the sulfonation of PrCO<sub>2</sub>H or its anhydride, from (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and EtCHBrGO<sub>2</sub>H or from EtCH(CO<sub>2</sub>H)<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>. *Aniline salt*, m. 175°. *p*-Toluidine salt, m. 163°. Heated with an excess of the base, the acid group also reacts. Thus PhNH<sub>2</sub> gives *aniline butyramide- $\alpha$ -sulfonate*, m. 253–6°. The corresponding *p*-toluidine deriv., m. 260–3°, the *p*-anisidine deriv., m. 242°, and that from *p*-phenetidine, m. 264–6°. Heated with *o*-C<sub>6</sub>H<sub>4</sub>(NH<sub>2</sub>)<sub>2</sub>, *benzimidazole-2-propylsulfonic acid*, results, while 3,4-(H<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Me yields *methylbenzimidazole-2-propylsulfonic acid*. The acid may be resolved by means of strychnine. The Ba salts of the active acids cryst. with 2.5 H<sub>2</sub>O (the *dl*-acid with 2H<sub>2</sub>O). The mol. rotation (Na light) of a 2.5% soln. of the Ba salt is 32.2°, of a 5% soln. 29.9°. 10% BaCl<sub>2</sub> in a 2.5% soln. lowers the rotation to 29.3°. The mol. rotation of the free acid (and acid salts) is 7.8°.

C. J. WEST

**Provisional communication on boric acid compounds of some organic substances containing more than one hydroxyl group.** Boron as a quinequivalent element. P. H. HERMANS. *Proc. Acad. Sci. Amsterdam* 26, 32–42 (1923).—In considering the behavior of H<sub>3</sub>BO<sub>3</sub> towards HO-contg. org. compds. it has been generally assumed that acid boric esters are formed which possess a higher degree of acidity than the free acid. The isolation by Dery (C. A. 16, 3081) of a cycloheptanediolboric acid (C<sub>7</sub>H<sub>13</sub>O<sub>7</sub>:BOH·H<sub>2</sub>O) led to the view that such compds. might be strong complex acids which cause the observed phenomena. This is not supported however by the prepn. of 2,4-dimethylpentane-2,4-diolboric acid, CH<sub>3</sub>.CMe<sub>2</sub>.OB(OH).O.CMe<sub>2</sub>, m. 100–2°, somewhat volatile,

with an odor of saffron, which is not a strong acid, hardly reddens blue litmus paper and does not cause an increase in the cond. of H<sub>3</sub>BO<sub>3</sub>. That the strongly acid B complexes must possess another structure than that which has thus far been assumed is confirmed by the isolation of similar weakly acid B compds. of 2,4-dimethylhexane-2,4-diol, 2,4-pentanediol and pinacol. Compds. exist but could not be isolated in the case of HO(CH<sub>2</sub>)<sub>4</sub>OH, HOCH<sub>2</sub>CH<sub>2</sub>OH and *cis*-1,2-cyclohexanediol; in the case of the last compd., the *K* salt crystals from concd. KOH; depending upon the strength of the KOH, C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>BK<sub>2</sub> or C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>BK seps. The *K* can be quant. detd. by titration with

Me orange.  $\alpha\text{-C}_6\text{H}_4(\text{OH})_2$  gives a B complex, the K salt of which analyzes for  $\text{C}_{10}\text{H}_8\text{O}_4\text{BK}$ . The K cannot be detd. by titration, which would indicate that this is a stronger acid compd. than those discussed above. The reaction of *cis*-cycloheptanediol with  $\text{H}_3\text{BO}_3$  is discussed; the *aniline salt*, m.  $50^\circ$ , was not analyzed. The  $\text{PhNH}_2$  is lost *in vacuo* at room temp. The structure of the various boric acids is discussed as a working hypothesis.

C. J. WEST

Preparation of various pinacols by the action of organomagnesium halides on certain  $\alpha$ -hydroxymethyl ketones. R. LOCQUIN AND SUNG WOUSSENG. *Compt. rend.* 176, 682-4 (1923); cf. C. A. 17, 1952.—Compds. of the type  $\text{RR}'\text{C}(\text{OH})\text{COMe}$ , allowed to react with 3 mols.  $\text{R}^*\text{MgX}$  ( $\text{R}^* = \text{Me, Et, Pr}$ ) gave fair yields of  $\text{RR}'\text{C}(\text{OH})\text{C}(\text{OH})\text{R}^*\text{Me}$ , with no tar. Completely substituted ethylene glycols with the following substituents were made: *methyltriethyl*,  $b_{11}$   $103-4^\circ$ ; *methyltripropyl*,  $b_{11}$   $137-40^\circ$ ; *tert-butyltrimethyl*,  $b_{13}$   $99-100^\circ$ ; *dimethyldiisopropyl*,  $b_{12}$   $110-2^\circ$ .

BEN H. NICOLET

Action of magnesium halides upon ethylglycerol epibromohydrin. RAYMOND DELABRY. *Compt. rend.* 176, 1326-7 (1923); cf. C. A. 17, 2264.—The epibromohydrins of either ethyl- or butylglycerol give no ppt. with Mg halides in 10% alc. soln., but upon boiling an excess of the bromohydrin with  $\text{MgBr}_2$  in alc. a ppt. of  $\text{Mg}(\text{OH})_2$  appears. With  $\text{MgCl}_2$  no ppt. is formed. By heating 1 mol.  $\text{MgCl}_2$  for 6 hrs. with ethylglycerol epibromohydrin, 0.5 mol. of  $\text{Mg}(\text{OH})_2$  was formed, but with  $\text{MgBr}_2$  no ppt. was formed, doubtless because of the formation of sol. oxybromide.

T. S. CARSWELL

"Internal salts." A. REYCHLER. *Bull. soc. chim. Belg.* 32, 247-50 (1923).—Betaine is prep'd. by mixing  $\text{ClCH}_2\text{CO}_2\text{Et}$  with a slight excess of  $\text{NMe}_3$  in alc., and heating to  $90^\circ$ . The ester, thus formed is sapond. by means of  $\text{HCl}$  and the free betaine is obtained from this soln. with  $\text{AgOH}$ . Taurine is prep'd. by heating bromoethylphthalimide with concd.  $\text{HCl}$  to  $200^\circ$ ; the  $\text{BrC}_2\text{H}_4\text{NH}_2\text{Cl}$ , thus formed, is heated with concd.  $(\text{NH}_4)_2\text{SO}_3$ . R. detcs. the mol. wt. and the sp. cond. of both compds.; he finds for a diln. of 4.1. for betaine a mol. wt. of 119.7 (instead of 135), and a sp. cond. of 0.00011 Kohlrausch units at  $18^\circ$ , for taurine a mol. wt. of 117.5 instead of 125 and a sp. cond. of 0.00008 Kohlrausch units at  $18^\circ$ .

R. BRUTNER

Synthesis of  $\beta$ -alanine from succinylglycine ester. THEODOR CURTIUS AND WILHELM HECHTENBERG. *J. prakt. Chem.* 105, 289-318 (1923).— $(\text{CH}_2\text{COCl})_2$  and  $\text{H}_2\text{NCH}_2\text{CO}_2\text{Et.HCl}$  react in  $\text{C}_6\text{H}_6$  to give *Et succinylglycinate*,  $\text{CO.CH}_2\text{CH}_2\text{CO.NCH}_2\text{CH}_2\text{CO}_2\text{Et}$ , anisotropic prisms, m.  $67^\circ$ ,  $b_m$   $198^\circ$  (yield, 52%).

$\text{N}_2\text{H}_4\text{.H}_2\text{O}$  opens the ring, giving a 92% yield of *hydrazidosuccinylglycinehydrazide* (I), m.  $167^\circ$  (decompn.). *Dibenzal deriv.*, m.  $218^\circ$  (decompn.). *Diacetone deriv.*, m.  $174^\circ$ . *Di-HCl salt*, m.  $174^\circ$ .  $\text{NaNO}_2$ , acting upon I in 16%  $\text{HCl}$  yields *azidosuccinylglycinazide* (II),  $\text{N}_3\text{COCH}_2\text{CH}_2\text{CONHCH}_2\text{CON}_3$ , glistening leaflets, which explode on warming. If an  $\text{Et}_2\text{O}$  soln. is warmed with abs.  $\text{EtOH}$ , the *urethan* (III), m.  $150-2^\circ$ , results in 26% yield. Hydrolysis of III with alc.  $\text{HCl}$  gives  $\text{CO}_2$ ,  $\text{EtCl}$ , an oil, b.  $160^\circ$ , and, from the  $\text{H}_2\text{O}$ -sol. portion, a benzosulfo compd. m.  $127^\circ$ , which was not  $\beta$ -alanine (IV). The  $\text{Et}$  ester of IV was not decompd. under similar conditions. When the hydrolysis was carried out with concd.  $\text{HCl}$ , a 30% yield of IV was obtained. Hydrolysis of II gave  $\text{N}_2\text{H}_4\text{.H}_2\text{O}$ ,  $(\text{CH}_2\text{CO}_2\text{H})_2$  and  $\text{H}_2\text{NCH}_2\text{CO}_2\text{H}$ . The *dianilide* of II, m.  $223-4^\circ$ , results from II in  $\text{Et}_2\text{O}$  and  $\text{PhNH}_2$ ,  $\text{N}_2\text{H}$  and  $\text{N}_2$  being also formed. Hydrolyzed by  $\text{HCl}$  in a sealed tube,  $\text{HO}_2\text{CCH}_2\text{CH}_2\text{NHCONHPh}$ ,  $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$  and  $\text{PhNH}_2$  are formed, thus indicating the constitution. If a carefully dried  $\text{Et}_2\text{O}$  soln. of II is poured into  $\text{CCl}_4$  and the  $\text{Et}_2\text{O}$  slowly distd.  $\text{N}_2$  is evolved and there results a cyclic *isocyanate*, (V)  $\text{HN.CH}_2\text{CH}_2\text{CO.N}(\text{CH}_2\text{N.CO})\text{CO}$ ,

m.  $93^\circ$  (decompn.); yield, 15%. The corresponding *urethan* m.  $124^\circ$ . Hydrolysis with concd.  $\text{HCl}$  at  $100^\circ$  gives IV and a high-melting compd., which on hydrolysis at  $110^\circ$  also gives IV. Heating the urethan at  $110^\circ$  with  $\text{HCl}$  gives only IV. *Anilide* of V, m.  $183^\circ$  (decompn.); *p-toluidide*, m.  $205^\circ$ .  $(\text{CH}_2\text{COCl})_2$  and free  $\text{H}_2\text{NCH}_2\text{CO}_2\text{Et}$  give a 50% yield of the diglycine ester. *Succinylidiglycinehydrazide*, m.  $220^\circ$ ; with  $\text{BzH}$  it gives a condensation product, m.  $238^\circ$ . If alc.  $\text{N}_2\text{H}_4\text{.H}_2\text{O}$  is used, the hydrazide, m.  $225^\circ$ , but the benzal compd. m.  $196^\circ$ . These were not investigated. *Ethylene isocyanate*,  $b_{25}$   $75^\circ$ ,  $b_{30}$   $105^\circ$ , results by the action of  $\text{NaNO}_2$  upon  $(\text{CH}_2\text{CONHNH}_2)_2$ , extn. of the azide with  $\text{CHCl}_3$  and warming on the  $\text{H}_2\text{O}$  bath. With  $\text{EtOH}$  it gives  $(\text{CH}_2\text{NHCO}_2\text{Et})_2$ , m.  $113^\circ$  and with  $\text{H}_2\text{O}$  ethyleneurea, m.  $131^\circ$ , and the compd.  $\text{C}_6\text{H}_5\text{N}_2\text{O}_2$ , does not m.  $300^\circ$ . *Ethylenediphenylurea*, m.  $245^\circ$  (decompn.).

C. J. WEST

Synthesis of  $\gamma$ -aminobutyric acid from glutarylglutamate. THEODOR CURTIUS AND WILHELM HECHTENBERG. *J. prakt. Chem.* 105, 319-26 (1923).—The *half chloride of glutarylglutamate ester*,  $\text{ClCOCH}_2\text{CH}_2\text{CH}_2\text{CONHCH}_2\text{CO}_2\text{Et}$ ,  $b_{14}$   $179-80^\circ$ , results in 30% yield from  $\text{CH}_3(\text{CH}_2\text{COCl})_2$  and  $\text{H}_2\text{NCH}_2\text{CO}_2\text{Et.HCl}$ . Allowed to stand 6 days

with concd.  $\text{NH}_4\text{OH}$  it yields *amidoglucarylglycineamide*, m. 188°. The *hydrasido-hydraside*, m. 166° (decompn.); *di-HCl salt*, m. 190° (decompn.); *disensal compd.*, m. 220°. *Asido-aside*, thick oil, which explodes when heated and gives the *urethan*, m. 143°, when treated with  $\text{EtOH}$ . Hydrolysis of the urethan in a sealed tube with concd.  $\text{HCl}$  at 100° for 5 hrs. gave 16% of  $\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{Et} \cdot \text{HCl}$ . C. J. W.

**Synthesis of anemoninic acid.** A. FUJITA. *J. Pharm. Soc. Japan* No. 492, 67-75(1923).—The principle of the synthesis is to reduce furfurallevulinic acid (I) to furfuryllevulinic acid (II) and to rupture the furan nucleus by Baeeyer's Br and  $\text{Ag}_2\text{O}$  method. I is prepd. by a slight modification of Kehrler and Hofacker's method (*Ann.* 294, 165). To 10 g. I in ice-cold  $\text{Na}_2\text{CO}_3$ , 100 g. of  $\text{Na-Hg}$  (3%) is added (neutral; acid or excess of alkali should be avoided). On neutralization with  $\text{H}_2\text{SO}_4$  are obtained crystals of II, m. 99° (semicarbazone, m. 125°). Reduction of I by H and Pt black was not successful. To 4 g. of II in 400 cc. warm  $\text{H}_2\text{O}$  3.3 g Br (as  $\text{Br-H}_2\text{O}$ ) is added in 1 portion. After addn. of 20.5 g.  $\text{Ag}_2\text{O}$  freshly prepd. from the nitrate, the mixt. is heated 3 hrs. at 70°. The resulting product does not crystallize. Following the method of conversion of  $\alpha$ - to  $\beta$ -anemoninic acid (cf. C. A. 14, 3227), the product is dissolved in 20%  $\text{HCl}$  and heated 1 min. and cooled. The crystals, m. 189°, are  $\beta$ -anemoninic acid,  $\text{HO}_2\text{C}(\text{CH}_2)_2\text{CO}(\text{CH}_2)_2\text{COCH}:\text{CHCO}_2\text{H}$ . The properties and compn. of the product thus prepd. are identical with those of the  $\beta$ -anemoninic acid prepd. from anemonin. S. T.

**Reduction of ethyl ethylenemalonate as affected by choice of reducing agent.** LUCY HIGGINBOTHAM AND ARTHUR LAPWORTH. *J. Chem. Soc.* 123, 1618-24(1923).—Reduction of  $\text{MeCH}:\text{C}(\text{CO}_2\text{Et})_2$  by H and Pd gave a practically quant. yield of  $\text{EtCH}(\text{CO}_2\text{Et})_2$ .  $\text{Na-Hg}$  gives products of at least 2 distinct types. The 1st has many of the characters of a  $\beta$ -ketonic ester and on alk. hydrolysis yields a volatile ketone, the semicarbazone of which m. 255° (decompn.). The main type of product appears to consist of  $[\text{-CHMe}(\text{CO}_2\text{Et})_2]_n$ , which, when hydrolyzed with  $\text{MeOH-KOH}$ , is converted into salts of mixed poly- $\text{CO}_2\text{H}$  acids; these, when distd., are converted into a mixt. of 2 isomeric di- $\text{CO}_2\text{H}$  acids; one of these m. 136-7° and is identical with a  $\beta,\beta'$ -dimethyl-adipic acid obtained by the action of Cu on  $\text{MeCHICH}_2\text{CO}_2\text{H}$ . The eutectic mixt. of the 2 acids m. about 63°. The mechanism of the reduction is discussed.

C. J. WEST

**Degradation of hydroaromatic acids of the glutaric acid series.** A. WINDAUS, F. KLÄNHARDT AND G. REVEREY. *Ber.* 55B, 3981-7(1922); cf. C. A. 15, 2627.—The earlier observations on the reaction of the Ag salts of aliphatic glutaric acids with I have been extended to acids which may be regarded as glutaric acids of which 1 or more C atoms are members of a hydroaromatic ring. The action is found to occur normally in the case of the *cis*-acids unless the glutaric acid substitutes a 5-membered ring in the 1,3-position.  $(\text{CH}_2)_6\text{C}:(\text{CO}_2\text{Ag})_2$  is converted by I into the *lactone*  $(\text{CH}_2)_5\text{C}:\text{C}(\text{CH}_2)_4\text{O} \cdot \text{CO} \cdot \text{CH}_2$ , viscous liquid,  $b_{113}$  273° (slight decompn.),  $b_{118}$  154°,  $d_{19.7}^{20}$

1.0755,  $n_D^{20}$  1.48386,  $n_D^{20}$  1.48668,  $n_D^{20}$  1.48631. The *Ba* and *Ag* salts of the corresponding *HO acid* were prepd. Oxidation of the lactone with alk.  $\text{KMnO}_4$  or by  $\text{CrO}_3$  gives  $(\text{CH}_2)_5\text{C}(\text{CO}_2\text{H})(\text{CH}_2)_4\text{CO}_2\text{H}$  (Norris and Thorpe, C. A. 15, 3824).  $\text{AgO}_2\text{-CCH}(\text{CH}_2)_4\text{-CHCH}_2\text{CO}_2\text{Ag}$  is converted by I into *hexahydrophthalide*,  $b_{113}$  134-8°,

the constitution of which was established by oxidation to  $\text{HO}_2\text{CCH}(\text{CH}_2)_4\text{CHCO}_2\text{H}$ .

The same lactone is obtained in smaller yield and with greater difficulty from the *trans*-salt. 1,3- $\text{C}_6\text{H}_4(\text{CO}_2\text{H})_2$  is hydrogenated in glacial  $\text{AcOH}$  to a mixt. of the *cis*- and *trans*- $\text{HOCC}_6\text{H}_4(\text{CH}_2)_2\text{CH}(\text{CO}_2\text{H})\text{CH}_2$ , in which the former predominates the more

considerably when the reduction proceeds rapidly. The *cis*-acid is not converted into the *trans*-form when shaken with glacial  $\text{AcOH}$  and Pt black. The Ag salt of the *cis*-acid, treated with I, gives *cis*-cyclohexanol-3-carboxylic acid lactone,  $b_{113}$  127-35°. Ag camphorate is transformed by I into camphoric anhydride; a neutral lactone does not appear to be produced.

C. J. WEST

**Syntheses of  $\gamma$ -hydroxy- and  $\alpha$ -amino- $\gamma$ -hydroxypimelic acids.** HERMANN LEUCHS AND WERNER NAGEL. *Ber.* 55B, 3950-60(1922).—The syntheses started from  $\text{CH}_3\text{CH}_2\text{CO} \cdot \text{O} \cdot \text{CHCH}_2\text{CH}(\text{CO}_2\text{Et})_2$  (I) (L. and Möbis, C. A. 3, 2136). Attempts

to halogenate the lactone ester or the corresponding acid in the malonic residue with subsequent elimination of the  $\text{CO}_2\text{Et}$  or  $\text{CO}_2\text{H}$  group led only to non-cryst. products

which, even after esterification, could not be distd. without decompn. *Monoanilide*,  $C_{16}H_{17}O_2N$ , m. 79-80°, by heating with  $PhNH_2$  at 160-70° for 0.5 hr. Hydrolysis of I by *N* NaOH and heating the resulting product *in vacuo* at 140° gives the lactone of  $\gamma$ -hydroxypimelic acid (II), m. 80-2.5°. MeOH-HCl converts II into Me  $\gamma$ -chloropimelate, which could not be purified but was characterized by conversion into  $\beta$ -pyrrolidonepropionamide, m. 144-5° (decompn.). Br and P, followed by MeOH, convert II into the Me ester of  $\alpha$ -bromo- $\gamma$ -hydroxypimelolactone (yield, 71%), which decompn. on distn. Hydrolysis with HBr, followed by treatment with  $NH_3$ , gives  $\alpha$ -amino- $\gamma$ -hydroxypimelic acid, which could be isolated only as the Cu salt; one of these crystallizes with  $1H_2O$ , sky-blue, and is the normal salt; the other 2, gray-blue with 0.5  $H_2O$ , are considered to be derived from the 2 racemic forms of the lactone. EtBr and EtONa convert I into the corresponding  $\alpha$ -Et deriv.,  $b_{11}$  206-8°, which is hydrolyzed to a non-cryst. acid and is converted into the diamide,  $C_{10}H_{16}O_4N_2$ , m. 170-1°, by MeOH- $NH_3$ . The acid, heated at 140°, loses  $CO_2$  and yields  $\alpha$ -ethyl- $\gamma$ -hydroxypimelolactone,  $CH_3CH_2CO.O.CH(CH_2)_2CO_2H$ . Me ester of the  $\alpha$ -bromo deriv.  $b_{14-16}$  180-200°;

treated with HBr and then with  $NH_3$ , this ester gives a product, isolated as the Cu salt,  $(C_6H_{11}O_4N)_2Cu.0.5H_2O$ , gray-blue. The free acid could be obtained only as a very hygroscopic, amorphous mass.

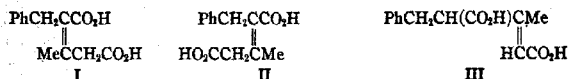
**Chemistry of the three-carbon system. I. The influence of the cyclohexane ring on the  $\alpha,\beta \rightarrow \beta,\gamma$ -change.** S. F. BIRCH, G. A. R. KON, W. S. G. P. NORRIS AND J. F. THORPE. *J. Chem. Soc.* 123, 1361-74 (1923).—In viewing the tautomerism of 3-elemental systems, the following conclusions may be drawn: (1) In an asym. glutamic system, as in a sym. system, the normal form  $[CR.C(H).C]$  is intermediate between the tautomeric individuals  $[CHR.C.C]$  and  $[CR.C.CH]$ . This follows from the existence of the normal form, proved in the case of  $\alpha$ - and  $\beta$ -methylglutaconic acids. (2) Definite 3-C tautomerism will be detected of the type  $CHR.C:C \rightleftharpoons CR:C.CH$ , corresponding to the keto-enol change  $CH.C:O \rightleftharpoons C:C.OH$  in which the occurrence of the intermediate normal phase is masked. (3) The keto-enol change itself takes place through an intermediate normal phase:  $CH.C:O \rightleftharpoons C.C(H).O \rightleftharpoons C:C.OH$ . Definite proof of (2) is given below. No expl. evidence of (3) is now available but it must be accepted, unless we are to adopt the wholly unreasonable view that 2 exactly similar types of phenomena, in the 3-C and keto-enol systems, possess totally different mechanisms. Kon (*C. A.* 15, 2829) assigned to cyclohexenylacetone (I) the

formula  $CH_2.CH_2.CH_2$  principally because of the normal optical behavior, the in-

ability to form addn. compds. with  $NH_2OH$  and the difficulty experienced in the reduction of the double bond with H and Pd. Norris and Thorpe (*C. A.* 15, 3824) ascribed to I the formula  $(CH_2)_3C:CHAc$ , because of the ready condensation with  $CHNa(CO_2Et)$ . It thus appeared as though I existed in the 2 tautomeric forms. In an attempt to settle the problem, I was synthesized from cyclohexylideneacetyl chloride and ZnMeI and from  $\Delta^1$ -cyclohexeneacetyl chloride and ZnMeI. In both cases the same product was obtained. In the 1st reaction the product was identified by the semicarbazone, m. 145°. A small amt. of an isomeric semicarbazone,  $C_{10}H_{17}ON_3$ , m. 169°, was also isolated, which may be that of cyclohexylideneacetone. Et cyclohexylideneacetate may be converted into Et  $\Delta^1$ -cyclohexeneacetate by heating 30 g. with 60 g.  $KHSO_4$  and 2 g.  $H_2O$  3 hrs. at 160°.  $\alpha$ -Ethyl- $\Delta^1$ -cyclohexenylacetone (II),  $b_{16}$  221°,  $d_{20}^{25}$  0.9181,  $n_D^{20}$  1.46926, was prepd. from I, EtI and EtONa, and also from  $\alpha$ -ethylcyclohexeneacetyl chloride and ZnMeI. Semicarbazone, m. 185°.  $\alpha,\alpha$ -Dimethyl- $\Delta^1$ -cyclohexenylacetone,  $b_{16}$  221°,  $d_4^{19}$  0.93288,  $n_D^{19}$  1.47565. Semicarbazone, m. 160-1°. Et  $\alpha$ -cyanocyclohexylideneacetate,  $b_{10}$  151°,  $d_4^{19}$  1.05394,  $n_D^{19}$  1.49670, condenses with  $NCCl_3CO_2Et$  and EtOH- $NH_3$  to form the  $\omega$ -imide of  $\alpha,\alpha'$ -dicyanocyclohexene-1,1-diacetic acid. In this case the equil. is greatly on the side of the  $\alpha,\beta$ -form. Et  $\alpha$ -cyano- $\alpha$ -methyl- $\Delta^1$ -cyclohexeneacetate,  $b_{13}$  133°,  $d_4^{20}$  1.04776,  $n_D^{20}$  1.47819. A comparison of the mol. refractivity of the Me deriv. with that of the parent compd. indicates that the latter must possess a system of conjugated double bonds which causes the very considerable exaltation observed. The action of EtONa upon Et  $\alpha$ -cyano- $\Delta^1$ -cyclohexeneacetyl chloride gives Et $_2$ CO $_2$  and  $\Delta^1$ -cyclohexeneacetyl chloride. C. J. W.

**Alkylglycerols. II. Conversion of vinylalkylcarbinols into alkylglycerols.** RAYMOND DELABY. *Bull. soc. chim.* 33, 711-25 (1923).—See *C. A.* 17, 537. E. J. C.  $\alpha$ -Benzyl- $\beta$ -methylglutaconic acids. FRANZ FEIST AND ED. RAUTENBERG. *Ber.* 55B, 3697-3705 (1922); cf. *C. A.* 16, 2307.—For the study of the action of  $O_3$  upon a

substituted glutamic acid which might be expected to yield stable decompn. products,  $\text{PhCH}_2\text{CH}(\text{CO}_2\text{H})\text{CMe}:\text{CHCO}_2\text{H}$  was chosen. The (normal) acid of higher m. p. and its esters and also the esters of the labile acid have the formula I, while the labile acid appears to be a mixt. of the two *trans*-forms II and III. The complex nature of



the latter product explains its low m. p. as compared with that of the homogeneous *cis*-acid. The *cis*-acid gives an *ozonide* which is hydrolyzed to  $\text{PhCH}_2\text{COCO}_2\text{H}$ , m. 153–4° (*phenylhydrazone*, m. 187–8° (decompn.)),  $\text{AcMe}$  and  $\text{CO}_2$ . The *ozonide* of its ester yields  $\text{PhCH}_2\text{COCO}_2\text{Et}$  and  $\text{AcCH}_2\text{CO}_2\text{Et}$ . The *trans*-acid, upon treatment with  $\text{O}_3$  and subsequent decompn., yields  $\text{AcOH}$ ,  $\text{PhCH}_2\text{CH}_2\text{COMe}$  and  $\text{BzOH}$ ; the formation of  $(\text{CO}_2\text{H})_2$  and  $\text{HCOCO}_2\text{H}$  could not be demonstrated. The *ozonide* of the Et ester yields upon decompn.  $\text{AcOH}$ ,  $\text{AcCH}_2\text{CO}_2\text{Et}$ (?),  $\text{PhCH}_2\text{COCO}_2\text{Et}$  and  $\text{BzOH}$ . Et *phenylpyruvate diphenylhydrazone*, yellow, m. 105°; *p*-nitrophenylhydrazone, yellow, m. 181°.

C. J. WESS

Electrolytic oxidation of tartaric acid. VAINO I. SHIVONEN. *Ann. acad. sci. Fennicae* 16A, No. 9, 188 pp.(1921).—The descriptions of the app., methods of manipulation and methods of calc. results fill 24 pages. The principal products of the electrolysis were  $\text{CO}_2$ ,  $\text{C}_2\text{H}_4$ ,  $\text{CO}$ ,  $\text{HCHO}$ ,  $\text{AcH}$ ,  $\text{CH}_2(\text{OH})\text{CHO}$ ,  $(\text{CHO})_2$ ,  $\text{HCOOH}$ ,  $\text{AcOH}$ ,  $\text{CH}_2(\text{OH})\text{CO}_2\text{H}$ ,  $(\text{CO}_2\text{H})_2$ ,  $\text{CHOCO}_2\text{H}$ ,  $\text{H}_2\text{O}$ ,  $\text{C}_2\text{H}_5\text{CH}_2\text{OH}$ ,  $\text{C}_2\text{H}_5\text{CHO}$ ,  $\text{CH}(\text{OH})(\text{CO}_2\text{H})_2$ ,  $\text{AcCO}_2\text{H}$ ,  $\text{CH}_2(\text{OH})\text{COCO}_2\text{H}$ ,  $\text{CHOCO}_2\text{H}$ ,  $\text{CO}(\text{CO}_2\text{H})_2$ ,  $\text{H}_2\text{O}$  and  $(\text{COCO}_2\text{H})_2$ . The sepn. of these from the products of electrolysis is described in 20 pages and the remaining 136 pages contain descriptions of electrolyses, the numerical results of which are shown in about 200 tables.

L. W. RIGGS

Structure of the normal monosaccharides. I. Xylose. E. L. HIRST and C. B. PURVES. *J. Chem. Soc.* 123, 1352–60(1923).—Recent work on the  $\delta$ -HO aldehydes and ketones has shown that these compds. react in the form of lactones containing an amylene-oxide ring and that they show a remarkable parallel in their behavior to aldoses and ketoses. The question of the structure of the O bridge in normal sugars and their derivs. may therefore be considered an open one. Xylose was chosen for the 1st study because oxidation of a methylated pentose presents a simpler case than that of the corresponding hexose deriv. in that a hexylene ring is automatically ruled out and the amylene-oxide structure would involve oxidation of a primary alc. group. 5 g. cryst. Me trimethylxyloside were oxidized with 80 cc.  $\text{HNO}_3$  (d. 1.20) at 80° for 6 hrs. After diln. with an equal vol. of  $\text{H}_2\text{O}$ , the  $\text{HNO}_3$  was removed by distn. *in vacuo* at 50°. The residue was then esterified with  $\text{MeOH-HCl}$  by boiling 6 hrs. and the  $\text{HCl}$  removed by  $\text{Ag}_2\text{CO}_3$ . Me *xylosyltrimethoxyglutarate*,  $\text{MeO}_2\text{C}[\text{CH}(\text{OMe})]_2\text{CO}_2\text{Me}$ ,  $b_p$  132°,  $n_D^{15}$  1.4402, optically inactive, does not reduce Fehling soln.; yield, 70%. The free *acid*, viscous yellow sirup, from which no cryst. salt could be prepd. *Diamide*, m. 195°, from  $\text{MeOH-NH}_3$  by standing 10 days at room temp. At the end of 4 days, the soln. was a deep blue, at the close reddish brown. Heated in the air,  $\text{NH}_3$  is evolved, the melt changing from a deep blue to brown. These color changes may be due to the formation of the imide, which then loses  $\text{MeOH}$  to form a dihydroxydimethoxypyridine. The inactivity of these products is not due to racemization during the vigorous oxidation process, since the more reactive *d*-tartaric acid showed no sign of racemization when treated under the same conditions. The absence of dimethoxysuccinic acid was definitely proved. These results would appear to indicate that xylose possesses an amylene-oxide linking, on the basis of which all the reactions of xylose can be explained. This does not imply that all the normal pentoses and hexoses are of the amylene-oxide type, and it is pointed out that there is need of independent investigation in the case of each of the sugars.

C. J. WESS

Glucosides. HENRI HÉRISSEY. *Bull. soc. chim.* 33, 349–413(1923).—An extensive review.

BEN H. NICOLET

Optical rotations of the sugars. II. The methylpentoses and the glucosides. J. G. MALTBY. *J. Chem. Soc.* 123, 1404–9(1923); cf. *C. A.* 17, 539.—The method previously described for investigating the rotations of the sugars has been extended to the methylpentoses and the glucosides. Values are given for the rotations of the  $\alpha$ -, equil. and  $\beta$ -forms of those methylpentoses with a positive  $(\alpha + \beta)/2$  value. M. believes that rhodose has the configuration 5+, 4+, 3+, 2–. The calcd. rotations of the Me glucosides derived from the pentoses, hexoses and methylpentoses with positive  $(\alpha + \beta)/2$  values are given. Comparison with the known values shows a large dis-

crepancy only in the case of  $\beta$ -Me arabinoside, small discrepancies in the case of Me mannoside and the Me methylrhamnosides. The approx. rotational values of group I for the glucosides of the various alcs. have been calcd. as follows: sugars,  $-84^\circ$ ; Me,  $-184^\circ$ ; Et,  $-194^\circ$ ; Pr,  $-200^\circ$ ; Bu,  $-210^\circ$ ; Am,  $-210^\circ$ ; allyl,  $-210^\circ$ ; PhCH<sub>2</sub>,  $-270^\circ$ ; Ph,  $-324^\circ$ . The  $\alpha$ -form has a greater numerical rotation than the  $\beta$ -form, except in the case of lyxose, mannose, gulose and rhamnose, where the converse holds good. This difference enables the 2 forms to be distinguished by their rotations, where these are known accurately. Because of mutarotation, the rotations cannot always be easily found. If the rotation diminishes to the equil. value, the isomeride originally present was the  $\alpha$ -form, whereas, if it increases, or if it changes sign, the isomeride was the  $\beta$ -form, except in the case of lyxose, gulose, allose and rhamnose. The isomeride formed in larger quantity by the cyanohydrin synthesis always has the same configuration as the  $\alpha$ -form of the sugar, since the configuration of group 2 in the product is always the opposite of that of group 4. Therefore,  $\alpha$ -guloheptonitrile (La Forge, C. A. 14, 944) will have the configuration: 6-, 5+, 4-, 3-, 2+.

C. J. WYER  
Glucose monosulfate and sucrose monosulfate. V. T. SODA. *Biochem. Z.* 135, 621-8(1923); cf. C. A. 17, 71.—The *brucine salt of glucose monosulfate* is prepd. as follows: Add dropwise to 16.5 g. glucose suspended in 75 cc. pyridine at  $-10^\circ$  a mixt. of 5 cc. CHSO<sub>3</sub> + 18 cc. CHCl<sub>3</sub>. Discontinue the cooling; shake for a time; let stand overnight. Distill the pyridine *in vacuo* at  $50^\circ$ . Dissolve the residue in H<sub>2</sub>O, shake overnight with PbO and BaCO<sub>3</sub>. Filter. Ext. 4 times with Et<sub>2</sub>O. Add Ag<sub>2</sub>SO<sub>4</sub>, and then H<sub>2</sub>S. Add BaCO<sub>3</sub>, blow off the H<sub>2</sub>S with CO<sub>2</sub> and evap. *in vacuo* at  $40^\circ$  to 15-20 cc. Remove any pptd. BaCO<sub>3</sub> by filtering through kieselguhr. On introducing the clear soln. into 1 l. abs. alc., the impure Ba salt is pptd. Treat 20.3 g. undried Ba salt with 15.7 g. brucine + 40 cc. N H<sub>2</sub>SO<sub>4</sub> in 200 cc. H<sub>2</sub>O + 80 cc. Me<sub>2</sub>CO. After removing the BaSO<sub>4</sub> evap. *in vacuo* until crystn. occurs. Redissolve the crystals by warming, add 80 cc. Me<sub>2</sub>CO, and set in the refrigerator. Wash the crystals in alc. Yield 14.7 g. m.  $183^\circ$  (decompn.),  $[\alpha]_D^{20} -5.60^\circ$  to  $-5.65^\circ$ . The Ba salt, prepd. by treating the brucine salt with Ba(OH)<sub>2</sub>,  $[\alpha]_D^{19} 31.71^\circ$ ,  $[\alpha]_D^{17} 32.32^\circ$ . The *Ba salt of sucrose monosulfate* is prepd. as follows: To 20 g. sucrose in 75 cc. pyridine add 3.5 cc. CHSO<sub>3</sub> + 10 cc. CHCl<sub>3</sub>. The next day digest in MeOH. Dil. this soln. with H<sub>2</sub>O and treat with PbO, BaCO<sub>3</sub> and AgNO<sub>3</sub>. The Ba salt is pptd. by dropping the aq. soln. into EtOH, and purified by repeated pptn.;  $[\alpha]_D^{22} 37.64^\circ$ .

GEORGE ERIC SIMPSON  
Compounds containing the trimethylene [cyclopropane] ring. P. BRUYLANTS AND A. STASSENS. *Bull. acad. roy. Belg.* 1921, 702-19.—Cyclopropanecarboxylnitrile, prepd. from  $\gamma$ -chlorobutyronitrile by distg. with dry KOH, contains crotono- or isocrotononitrile. The pure cyclonitrile  $b_{762.5} 134-34.2^\circ$ . Pure cyclopropanecarboxylic acid m.  $18.1^\circ$  and  $b_{768} 181.8-2^\circ$ . The corresponding chloride, on chlorination, at the b. p. gives (a) *1-chlorocyclopropanecarboxyl chloride*, b.  $141-3^\circ$ ,  $d_4^{20} 1.336$ ,  $n_D^{20} 1.4759$ , and (b) a small amt. of what is apparently  $\alpha,\gamma$ -dichlorobutyryl chloride, b.  $212-14^\circ$ . The (a) was converted by water into *1-chlorocyclopropanecarboxylic acid*, m.  $70-1^\circ$ , b.  $206^\circ$ ; Na salt, hygroscopic needles; *Me ester*,  $b_m 152-3^\circ$ ,  $d_4^{20} 1.179$ ; *Et ester*,  $b_{15} 65-6^\circ$  or  $b_{768.5} 162-3^\circ$ ,  $d_4^{20} 1.126$ ,  $n_D^{20} 1.4417$ ; *amide*, m.  $131-2^\circ$ . Et 1-chlorocyclopropanecarboxylate with MeMgBr is converted into a *chlorohydrin*, C<sub>3</sub>H<sub>5</sub>ClCMe<sub>2</sub>OH,  $b_{768} 156.5-7^\circ$ ,  $d_4^{20} 1.065$ , forms an *acetate*,  $d_4^{20} 1.086$ , and is almost unaffected by hot aq. KOH. The Cl atom in 1-chlorocyclopropanecarboxylic acid is not reactive enough to permit of the prepn. of derivs. by its replacement. The constitution of the acid was decided from cond. measurements with the acid and its Na salt, whence the disoc. const. (100 k) was found to be between 0.05 and 0.06, a value only to be explained if the Cl group is in the  $\alpha$ -position. By treating the higher-boiling fractions of the above chlorination with MeOH in presence of a little H<sub>2</sub>SO<sub>4</sub>, Me  $\alpha$ -chlorocyclopropanecarboxylate and Me  $\alpha,\gamma$ -dichlorobutyrate, b.  $212-14^\circ$ , were obtained. The mol. heats of combustion of cyclopropanecarboxylic acid at const. vol. and at const. pressure were found to be 486.1 and 486.4 cal., resp., whereas for crotonic acid the value is 478.0 cal. The heat of formation of the acid in the liquid state is 97.8 cal. (crotonic acid, 102.3 cal.). Detns. of the viscosities and m. ps. of mixts. of cyclopropanecarboxylic acid with water are described, and point to the existence of a hydrate, C<sub>3</sub>H<sub>5</sub>O<sub>2</sub>·H<sub>2</sub>O.

J. C. S.  
Hydrogenation of benzene. GREGG DOUGHERTY AND H. S. TAYLOR. *J. Phys. Chem.* 27, 533-57(1923).—An attempt has been made to gain some insight, by kinetic measurements, into the mechanism of the catalytic reduction of C<sub>6</sub>H<sub>6</sub> to C<sub>6</sub>H<sub>12</sub>. The results indicate that the reaction does not occur at all according to the stoichiometric equation, as calcd. from gas concns., but at rates governed by the distribution of the

reacting materials between the catalyst and the gas phase. The trend of the reaction with change of temp. was studied and equil. values at the higher temps. have been calcd. The results on the latter show that apparent equil. in the gas phase, as measured in this way, do not necessarily coincide with those which would be expected on the basis of the ordinary equation representing the reaction.  $\text{H}_2\text{O}$  vapor in small amts., up to 2% of the H vols. used in the reaction mixt., had only a slightly depressing effect on the reaction velocity. CO in the same amt. had a very marked poisoning effect, particularly at the low temp. of  $100^\circ$  or under. As the reaction temp. was raised the poisoning was less noticeable. In large quantities, however, around 50% CO, the reaction was completely stopped at  $180^\circ$ .  $\text{C}_2\text{H}_{12}$  at low temps. ( $100^\circ$  or less) had a depressing effect on the reaction velocity, but this disappeared in the neighborhood of  $180^\circ$ . It is necessary to use great care in making comparative measurements on account of the variability of the Ni catalyst. It was found that different catalysts, although prepd. exactly in the same manner might have quite different activities and that the activity of a given catalyst changed markedly with time and use. Quant. measurements on a reaction of this kind are difficult because of the fact that the actual reactant concns., on which the velocity of the reaction depends, are those on the catalyst surface and these concns. may be independent of, or bear a varying relation to, the reactant concns. in gas phase. The temp. coeff. of the reaction measured is approx. 1.65 per  $10^\circ$  rise. This is evidently the temp. coeff. of a chem. reaction as opposed to that of a diffusion process.

C. J. WEST

Is it necessary and is there sense in the looking for a new structural formula for benzene? P. H. HERMANS. *Chem. Weekblad* 20, 326(1923).—H. gives a historic review of the well known development of structural chemistry, starting from the work of Kékulé. The great difficulties of the problems in question have not been solved in a large no. of investigations by the most prominent chemists, because too little is known on the nature of the intermol. chem. forces. A new hypothesis, as the one of Lely (C. A. 17, 1788), is not justified, therefore.

R. BEUTNER

The rule of substitution. C. W. A. LELY. *Chem. Weekblad* 20, 361-2(1923).—Reply to Hermans (C. A. 17, 2567).

R. BEUTNER

Addition compounds of aluminium chloride with hydrocarbons. Friedel-Craft's synthesis. A. SCHLEICHER AND E. BÜTTGENBACH. *J. prakt. Chem.* 105, 355-60 (1923).— $\text{C}_6\text{H}_5\text{Et}_3$  and  $\text{C}_6\text{Et}_6$  form compds. with  $\text{AlCl}_3$ . The proof of the existence of the 1st addn. compd. is furnished by the confirmation of Gustavson's expts., of the latter by the interaction of the 2 components. The resulting product is identical with that obtained by Gustavson through the Friedel-Craft synthesis. The compd. with  $\text{C}_6\text{Et}_6$  appears to be stable at  $90^\circ$  but above that temp.  $\text{EtCl}$  is split off and various Et derivs. result.

C. J. WEST

Formation of hydrocarbons during the action of potassium on ethyl acetate. HELMUTH SCHEIBLER, HEINRICH ZIEGLER AND EMIL PFEFFER. *Ber.* 55B, 3921-31(1922).—In the reaction of K and  $\text{EtOAc}$  there are formed  $\text{CH}_3\text{C(OK)OEt}$ , acidic substances and neutral compds., the latter of which are here discussed. K and  $\text{AcOEt}$  in various proportions are caused to react in the presence of  $\text{Et}_2\text{O}$  and the reaction products decompd. by 30%  $\text{H}_2\text{SO}_4$  or  $\text{CO}_2$ . The neutral portions are freed from esters and ketones by successive treatment with concd. KOH at  $80^\circ$  and  $\text{NaHSO}_3$  and then distd. The C and H contents of these increase with increasing b. p. at the expense of the O content. The fraction b.  $210-40^\circ$  analyzes for  $\text{C}_{12}\text{H}_{22}$ , that b. above  $250^\circ$  for  $\text{C}_{12}\text{H}_{24}$ . Their constitution is unknown. The insoly. of the bulk of the product in concd.  $\text{H}_2\text{SO}_4$  indicates the absence of olefins and the low H content makes it unlikely that paraffins are present. It is most probable that the hydrocarbons are homologs of  $\text{C}_6\text{H}_6$  or mono- or polycycloparaffins. Only traces of H are evolved in the gaseous state during the action of K on  $\text{EtOAc}$ . It appears that the liberated H reduces a portion of the  $\text{CH}_3\text{C(OK)OEt}$  and that in the course of the change intermediate substances are produced which are more readily hydrogenated than  $\text{CH}_3\text{C(OK)OEt}$ , a considerable proportion of which remains after complete soln. of the K. The fractions b. below  $200^\circ$  consist mainly of hydrocarbons, but appear to contain a certain proportion of ethers; their instability towards alk.  $\text{KMnO}_4$  indicates their unsatd. nature. The formation of hydrocarbons is not observed when K is replaced by Na under otherwise identical conditions.

C. J. WEST

Some constants of phenylchloroform (tri- $\omega$ -chlorotoluene). FRED. SWARTS. *Bull. soc. chim. belg.* 31, 375-7(1922).—A redetn. of some of the phys. consts. of  $\text{PhCCl}_3$ , gave the following values: m.  $-4.75^\circ$ ;  $b_D^{20}$   $110.7^\circ$  or  $b_M^{20}$   $220.7^\circ$ ;  $d_4^{15}$  1.3775. The f. p. const. has the notably high value  $93.1^\circ$ . Moist air in contact with the substance causes rapid and considerable lowering of the f. p., previous values for which are  $-22.5^\circ$



(Haase, *Ber.* 26, 1052-4(1893).—17° (Altschul, *Z. physik. chem.* 16, 24-5(1895)), and —3.1 (Timmermans, *C. A.* 9, 9). J. C. S.

The influence of substituents in the components on the equilibrium in binary solutions. **XLI. Binary solution equilibrium of the isomeric dinitrotoluenes with amines or hydrocarbons.** ROBERT KREMANN, EUGEN HÖNIGSBERG AND OTTO MAUERMANN. *Monatsh.* 44, 65-81(1923); cf. *C. A.* 17, 1462.—1,3,4-(O<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Me forms the following eutectics: at -17° with 69% PhNH<sub>2</sub>; 11° with 41% *p*-MeC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub>; 33° with 28% β-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub>; -10° with 54% α-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub>; 39° with 30% acenaphthene; 55° with 2% anthracene; 37° with 29% fluorene. 1,2,6-(O<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Me forms the following eutectics: at 18° with 55% *p*-MeC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub>; at 7.5° with 62% α-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub>; at 45° with 24% β-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub>; at 54° with 6% anthracene; at 46° with 30% fluorene; 46° with 27% acenaphthene. 1,3,5-(O<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Me forms an eutectic at 42° and 39% fluorene and at 76° with 14% anthracene. With PhNH<sub>2</sub>, there is a break in the curve at 46° and 32% PhNH<sub>2</sub>, and a 2nd at -13° and 92% PhNH<sub>2</sub>. An equimol. compd. exists at 46.5° (33.8% PhNH<sub>2</sub>). With *p*-MeC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub>, the breaks occur at 22° and 61% *p*-MeC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub> and at 25° and 50%. In the system with α-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub>, there are breaks at 75° (12%) and 40° (87%), with an equimol. compd. at about 108°. β-C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub> gives 2 eutectics at 53° (27 and 40%), which by extrapolation indicates an eutectic at about 44° and 33%. The breaks in the curve with acenaphthene occur at 72° (15%) and 79° (73%) with an equimol. compd. at 94° (45.9%). 1,2,4-(O<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Me forms a simple eutectic with *p*-H<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>Me at 15° (50%). C. J. WEST

**Diazotization of nitroaniline.** CHARLES SUNDER AND HENRI SUNDER. *Bull. soc. ind. Mulhouse* 89, 237-40(1923).—Apart from the purity of the C<sub>6</sub>H<sub>4</sub>(NH<sub>2</sub>)NO<sub>2</sub> (I) the most important factors are: method of diazotization, fineness of the product, working temp., excess of mineral acid. With a small excess of acid (10% HCl over the theoretical amt. required to form the diazonium chloride) 4 kg. of I can be diazotized at a time by pouring the whole of the acid at once into the I suspended in dil. NaNO<sub>2</sub>. With a large excess of mineral acid the whole of the diazonium chloride must be converted into acetate; but with 10% free HCl dyeing can be obtained with 0.859 mol. of I as diazonium chloride and 0.141 mol. as acetate. NaHPO<sub>4</sub> can be used as neutralizer instead of AcONa; or H<sub>3</sub>PO<sub>4</sub> can be used instead of HCl, the excess being neutralized with NaOH. Working on a small scale at 10°, S. and S. successfully used the following proportions: 1 mol. of I, 1 mol. of NaNO<sub>2</sub>, 1.1 mols. of HCl, 1.1-2 mols. of AcOH, and did not need to add AcONa, which was formed by the action of AcOH on NaNO<sub>2</sub>. A. PAPINEAU-COUTURE

**The enantiotropic transformation of phthalylphenylhydrazide.** FUSAO ISHIKAWA. *Rikugaku Kenkyujo Iho* 2, 264-7(1923).—Chattaway and Lambert (*C. A.* 10, 754) measured the soly. of phthalylphenylhydrazide in CHCl<sub>3</sub>, AcOEt, and Me<sub>2</sub>CO and detd. its transition point to be 9.5°. On the basis of the soly. data, I. has calcd. the transition heat, transition point, and transition affinity of the compd. The transition heats of 1 g. of the light yellow to the deep yellow modification at 9.5° in CHCl<sub>3</sub> and AcOEt are 2.72 and 2.89 cal., resp. From the soly. in CHCl<sub>3</sub> at 5° and 15°, the transition point was calcd. to be 9.4°. From the soly. in CHCl<sub>3</sub>, the following transition affinities per g. mol. were calcd.: β → α, 5°, 5.75; 8°, 2.38; 9°, 1.26; α → β, 10°, 1.78; 11°, 2.28; 15°, 7.41; 25°, 21.49. From the soly. at 25°, the transition affinities in CHCl<sub>3</sub>, AcOEt, and Me<sub>2</sub>CO per g. mol. are 21.49, 21.35, and 21.98 g. cal., resp. K. KASHIMA

**Preparation of some azo derivatives.** DINO BIGIARI AND GINO CARRARA. *Gazz. chim. ital.* 53, 285-90(1923).—The azoxyphenols, HOCH<sub>2</sub>N(:O):NC<sub>6</sub>H<sub>4</sub>OH, are now quite generally prepd. by oxidizing the corresponding azo deriv. with AcOH + H<sub>2</sub>O<sub>2</sub>. The corresponding nitro derivs. [4,3-HO(O<sub>2</sub>N)C<sub>6</sub>H<sub>3</sub>N:]<sub>2</sub> described here were obtained quant. by the action of HNO<sub>3</sub> on the azo derivs. In this reaction the NO<sub>2</sub> is substituted *o*- to the OH when the mol. contains the group :NC<sub>6</sub>H<sub>4</sub>OH but HNO<sub>3</sub> does not react with the =NPh, =N(:O)Ph or =N(:O)C<sub>6</sub>H<sub>4</sub>OH groups. It is thus possible to det. the position of the azoic OH group, since PhN(:O):NC<sub>6</sub>H<sub>4</sub>OH, *e. g.*, reacts with HNO<sub>3</sub>, while PhN:N(:O)C<sub>6</sub>H<sub>4</sub>OH does not. In the case of HOCH<sub>2</sub>N:N(C<sub>6</sub>H<sub>4</sub>OH)<sub>2</sub> 2 mols. of *p*-HOCH<sub>2</sub>H<sub>2</sub>NO<sub>2</sub> also are formed. This reaction also occurs with KMnO<sub>4</sub> in neutral or alk. soln. and with H<sub>2</sub>O<sub>2</sub> in excess. The reaction is comparable to the action of KMnO<sub>4</sub> upon hyponitrous acid, HON:NOH, giving 2 mols. O<sub>2</sub>NOH (*Atti accad. Lincei* 31, I, 488(1922)). An improved method of prepn. for (*p*-HOCH<sub>2</sub>N:N:)<sub>2</sub> (I) is described. 10 g. I dissolved in sufficient warm AcOH were treated with 14 g. perhydrol for 25 hrs. at 70-80°. On cooling *p,p'*-dihydroxyazoxybenzene (II), sep'd. in red-yellow needles, m. 224° (decompn.). 3 g. (*p*-AcOC<sub>6</sub>H<sub>4</sub>N:)<sub>2</sub> (Fichter, Jaack, *C. A.* 16, 710) in 70 cc. glacial AcOH with 5 g. perhydrol at 70-80° for 24 hrs. and then 10 g. more

perhydroly for 20 hrs. sepd. on cooling diacetyl-*p*-azoxyphenol, m. 163° (Wohl, *Ber.* 36, 4150 (1903)). 10 g. benzenediazophenol in 150 cc. glacial AcOH + 10 g. NaNO<sub>2</sub> sepd. in 24 hrs. *m*-nitro-*p*-hydroxyazobenzene. To 2 g.  $\alpha$ -*p*-hydroxyazobenzene in 30 cc. glacial AcOH 2 g. NaNO<sub>2</sub> added in the course of an hr. sepd.  $\alpha$ -*m*-nitro-*p*-hydroxyazobenzene, PhN(:O)NC<sub>6</sub>H<sub>4</sub>(OH)NO<sub>2</sub>, greenish yellow, m. 125°. Another method of prepn. is also described. 1 g. II treated similarly with 30 cc. glacial AcOH and 0.8 g. NaNO<sub>2</sub> gave *m*-nitro-*p*,*p*'-dihydroxyazobenzene, yellow-orange, m. 193° (decompn.). 5 g. I in 100 cc. glacial AcOH were treated with 4 g. NaNO<sub>2</sub>. A dark green ppt. sepd. This was treated with 5% NaOH. The dissolved portion was reprecipitated with H<sub>2</sub>SO<sub>4</sub>. The ppt. was extd. for 2 hrs. with Et<sub>2</sub>O under a condenser. The residue insol. in Et<sub>2</sub>O was [4,3-HO(O<sub>2</sub>N)C<sub>6</sub>H<sub>4</sub>]<sub>2</sub>N<sub>2</sub>O, m. 236° (decompn.) (Robertson, *C. A.* 7, 3751). The filtrate from the 1st ppt. gave *p*-NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>OH on evapn.

E. J. WITZEMANN

**Derivatives of aminoarsenobenzene and their color.** E. CHABANIER, *Mon. sci.* [5] 13, 102-3 (1923).—A low temp. of reduction in the prepn. of dihydroxydiaminoarsenobenzene considerably decreases its toxicity, while the no. of NH<sub>2</sub> groups in the dihydroxyaminobenzene nucleus has little effect upon the toxicity. The prepn. of white aminoarsenobenzene-HCl showed that the —As— group was not a chromophore, which is in contradiction to the toxicity theory of Christiansen (*C. A.* 15, 1528).

T. S. CARSWELL

**Action of sulfonyl chloride on organic substances. II.** T. H. DUKRANS, *J. Chem. Soc.* 123, 1424-9 (1923); cf. *C. A.* 16, 1228.—BzOCH<sub>2</sub>Ph and 5 mols. SO<sub>2</sub>Cl<sub>2</sub> give BzCl and BzOH, Bz<sub>2</sub>O probably being an intermediate product. AcOCH<sub>2</sub>Ph is, in the main, unattacked by SO<sub>2</sub>Cl<sub>2</sub>, only small ams. of Ac<sub>2</sub>O and BzOH being produced. Bz<sub>2</sub> is not attacked. Anisole gives the 2,4,6-Cl<sub>3</sub> deriv. (Hugounenq, *Ann. chim. phys.* [6] 20, 521 (1890)). *o*-HOC<sub>6</sub>H<sub>4</sub>CHO gives the 5-Cl deriv. *p*-MeOC<sub>6</sub>H<sub>4</sub>CHO gives the 3,5-dichloro deriv., bright red, m. 61.5°, identified by oxidation to the acid, m. 202°. PhCH:CHCHO gives  $\alpha$ , $\beta$ -dichloro- $\beta$ -phenylpropaldehyde, b<sub>10</sub> 151-3°, did not solidify —12° and had a sharp odor, like O<sub>2</sub>. Oxidation with HNO<sub>3</sub> gives an acid, which on hydrolysis with NaOH yields  $\omega$ -chlorostyrene. It does not correspond with the properties ascribed by Naar (*Ber.* 24, 246). PhCH:CHCO<sub>2</sub>H gives PhCHClCHClCO<sub>2</sub>H, m. 167-8°. *o*-H<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>CO<sub>2</sub>H gives 2,3,5-H<sub>3</sub>NC<sub>6</sub>H<sub>3</sub>CO<sub>2</sub>H, m. 223°, the *Ac* deriv. of which m. 278°. Anethole gives a compd., C<sub>10</sub>H<sub>10</sub>OCl<sub>4</sub>, m. 70.5°, b<sub>17</sub> 191°, which loses 1 Cl with EtOH-AgNO<sub>3</sub> and with *N*-EtOH-NaOH yields the compd. C<sub>10</sub>H<sub>9</sub>OCl<sub>3</sub>, b<sub>10</sub> 184°, m. 36°, with a faint odor of Am salicylate. Methylchavicol gives a Cl<sub>2</sub> deriv., C<sub>10</sub>H<sub>10</sub>OCl<sub>4</sub>, b<sub>18</sub> 199°, does not solidify —15°.

C. J. WEST

**Substitution in vicinal trisubstituted benzene derivatives. I.** WM. DAVIES, *J. Chem. Soc.* 123, 1575-93 (1923).—A study has been made of the position of substitution in the bromination and nitration of *o*-vanillin (I). Nitration of I in glacial AcOH gives the 5-NO<sub>2</sub> deriv. (Rupp and Linck, *C. A.* 9, 2233), which, treated with MeI and Ag<sub>2</sub>O in CHCl<sub>3</sub>, gives 5-nitro-2,3-dimethoxybenzaldehyde, m. 115°; boiling 15 min. with *N* NaOH gives the original 5-NO<sub>2</sub> deriv., which is considered strong evidence for the position of the NO<sub>2</sub> group. Its constitution is further confirmed by oxidation with KMnO<sub>4</sub> to 5-nitro-*o*-veratric acid. To ascertain whether the remarkable contrast in the position of substitution which obtains in the nitration of *o*-veratraldehyde and *o*-veratric acid holds for other derivs. of *o*-vanillin, such derivs. were studied. The *Ac* deriv. could not be nitrated because of hydrolysis. 2,3-PhO<sub>2</sub>SO(MeO)C<sub>6</sub>H<sub>3</sub>CHO, added at once to fuming HNO<sub>3</sub> at 12°, allowed to rise to 20°, and after 10 min. poured into H<sub>2</sub>O, gives some 6-nitro deriv., faintly yellow, m. 145°; in light it changes to greenish blue. Warmed with NaOH in AcMe, a deriv. of indigotin is formed. Oxidized with KMnO<sub>4</sub>, the corresponding benzoic acid, m. 218°, is obtained. 2,3-PhO<sub>2</sub>SO(MeO)C<sub>6</sub>H<sub>3</sub>CO<sub>2</sub>H, m. 209°, upon nitration, gives the above NO<sub>2</sub> acid, m. 218°. 2,3,5-Dimethoxybromobenzaldehyde, sternutatory needles, m. 81°, results upon methylation of bromo-*o*-vanillin, or the bromination of *o*-veratraldehyde. Nitration gives the 6-nitro deriv., faintly yellow, m. 141°. It is readily converted into a deriv. of indigotin by AcMe and NaOH. 5-Bromo-*o*-veratric acid, m. 120° and distills practically unchanged at a high temp. 3-Ethoxysalicylaldehyde, b<sub>17</sub> 263-4°, m. 64-5°. 5-Nitro deriv., light yellow, m. 158°. Ag<sub>2</sub>O and MeI in CHCl<sub>3</sub> convert this into 5-nitro-2-methoxy-3-ethoxybenzaldehyde (I), m. 118.5°. This does not yield an indigotin deriv. with AcMe and NaOH. 2 *N* NaOH splits off the Me group, giving the original 5-NO<sub>2</sub> deriv. 5-Nitro-2-methoxy-3-ethoxybenzoic acid, m. 177°. No color is produced by FeCl<sub>3</sub>. With 2 *N* NaOH the 2-HO deriv. is produced, m. 205°. FeCl<sub>3</sub> gives an intense brownish violet color. Na salt, 2-Methoxy-3-ethoxybenzaldehyde, m. 45°. Nitration gives at least 2 isomers, of which one is I. The other is probably the 6-NO<sub>2</sub> deriv. 2-Methoxy-3-

ethoxybenzoic acid, m. 59°. Nitration gives the 5-nitro deriv., m. 175-7°, also obtained by oxidation of the corresponding aldehyde deriv., and probably the 6-nitro deriv., m. 157.5°, which is more sol. in H<sub>2</sub>O and EtOH than its isomer. 5-Bromo-2-hydroxy-3-ethoxybenzaldehyde, yellow, m. 94°, gives a blue color with FeCl<sub>3</sub> and a red hydrazone. 2-MeO deriv., m. 95°, also obtained by bromination of 2,3-MeO(EtO)C<sub>6</sub>H<sub>3</sub>CHO. The nitro deriv., pale yellow, m. 128°, gives a colored indigotin deriv. C. J. WANS.

**Action of organomagnesium compounds on nitriles. Action of phenylmagnesium bromide.** LOUIS BARY. *Bull. soc. chim. Belg.* 31, 397-410(1922).—The action of PhMgBr on nitriles has been studied to compare it with that of Mg Me and Et bromides (cf. Bruylants, *Bull. sci. acad. roy. Belg.* [v] 8, 7(1922); Baerts, *C. A.* 17, 1428). In general far higher yields of ketone are obtained than is the case with the Mg Me and Et bromides, none at all, e. g., being formed when these react with MeCN, whereas PhMgBr gives a yield of about 45% of ketone. In the aliphatic nitriles, the yield of ketone increases with increase of the length of the C chain. In PhCN, the intermediate product, CPh<sub>2</sub>NH, was isolated in 75% yield, and is characterized by exceptional stability compared with those ketimines in which an alkyl group is united to the ketonic C. This is attributed to the fact that in Ph<sub>2</sub>C:NH there is no possibility of tautomeric change of the type NH:CRCH<sub>2</sub>Me  $\rightleftharpoons$  NH<sub>2</sub>CR:CHMe. The nitrile of cyclopropanecarboxylic acid also gave a good yield of phenylcyclopropyl ketimine, a liquid of pungent, disagreeable odor, b<sub>25</sub> 135-6°, d<sub>20</sub><sup>20</sup> 1.0663, n<sub>D</sub><sup>20</sup> 1.56201. It is rapidly converted by dil. acid into Ph cyclopropyl ketone (Perkin, *J. Chem. Soc.* 47, 840(1885)), a liquid of pleasant odor, b. 239°, d<sub>4</sub><sup>20</sup> 1.0566, n<sub>D</sub><sup>20</sup> 1.5565. The semicarbazone m. 189°. PhCH<sub>2</sub>CN, MeCN, EtCN and PrCN yielded the ketone and condensation products, but the ketimine was not obtained. J. C. S.

**4-Fluoro-3-nitrobenzoic acid.** H. ROUCHS. *Bull. sci. acad. roy. Belg.* 1921, 534-47.—4-FC<sub>6</sub>H<sub>4</sub>CO<sub>2</sub>H, on treatment with HNO<sub>3</sub> (d. 1.495), is converted to the extent of 80% into 4-fluoro-3-nitrobenzoic acid, m. 121.5°, 4-FC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub> also being formed as the result of the displacement of the CO<sub>2</sub>H group by the nitro group. The new acid forms sol. and highly colored salts (alkali metals, red; alk.-earth metals, yellow or orange). The Ag salt is unstable. The Et ester, yellow crystals, m. 45.3°. The chloride, b<sub>100</sub> 210°, on treatment with NH<sub>4</sub>OH, gives 3-nitro-4-aminobenzamide, dry NH<sub>3</sub> in Et<sub>2</sub>O, however, giving 4-fluoro-3-nitrobenzamide, a waxy mass, m. 153°. The solubilities of 4-fluoro-, 4-chloro-, and 4-bromo-3-nitrobenzoic acids have been compared. The disoc. consts. (100 k) of 4-fluoro- and 4-chloro-3-nitrobenzoic acids were found to be, resp., 0.0433 and 0.048 (cf. Bethmann, *Z. physik. Chem.* 5, 385-422), the corresponding 4-Br acid being stronger than these two acids. *p*-FC<sub>6</sub>H<sub>4</sub>CO<sub>2</sub>H, used in comparison, gave 100 k 0.00735. Owing to the labile nature of the F group in F(O<sub>2</sub>N)C<sub>6</sub>H<sub>3</sub>CO<sub>2</sub>H, cond. detns. with the latter were carried out in presence of HCl. A study of the velocities of reaction with NaOMe of F(O<sub>2</sub>N)C<sub>6</sub>H<sub>3</sub>CO<sub>2</sub>Na and *o*-FC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub> showed that the CO<sub>2</sub>H group renders a *p*-F group more labile. J. C. S.

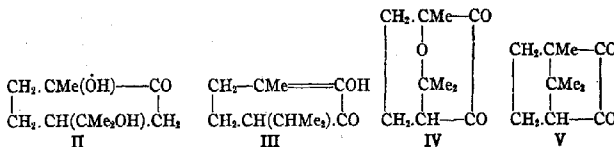
**Resolution of ( $\alpha$ )-*m*- and *p*-nitrophenoxypionic acids.** E. FOURNEAU AND G. SANDULESCO. *Bull. soc. chim.* 33, 459-65(1923); cf. *C. A.* 17, 380.—In continuation of previous work, the following new compds. of  $\alpha$ -*m*-nitrophenoxypionic acid (I) and the corresponding *p*-nitro deriv. (II) are described: *d*-I, m. 109-10°; *d*-II, m. 130-40°; *d*- (or *l*-) I, m. 101-2°, [ $\alpha$ ]<sub>D</sub><sup>21</sup> = 51.87°; *d*- (or *l*-) II, m. 80-90°, [ $\alpha$ ]<sub>D</sub><sup>21</sup> = 53.7°. Attempts at resolution with the bases mentioned gave the following results, for I and II, resp.: cinchonine, oily ppt., very poor yield of *l*-acid; strychnine, good yield of *l*-acid, no resolution; brucine, —, no resolution; quinidine, oily ppt., very pure *d*-acid; yohimbine, —, *l*-acid in good yield. [ $\alpha$ ]<sub>D</sub><sup>21</sup> (0.8% in abs. alc., 20-cm. tube) is given for the following salts: quinidine salt of *d*-II, 172.5°; yohimbine salt of *l*-II, 20.6°; strychnine salt of *l*-I, -25.0°. BEN H. NICOLET

**A molecular rearrangement in the pseudobutyldiphenylcarbinol series.** PAULINE RAMART. *Compt. rend.* 176, 684-6(1923).—A mixt. of AcCl and Ac<sub>2</sub>O converts Ph<sub>2</sub>C(OH)CMe<sub>2</sub> (I) to Ph<sub>2</sub>MeCClCMe<sub>2</sub> (II), and also a hydrocarbon, thought to be the intermediate product, and having probably one of the following formulas (III and IV). Ph<sub>2</sub>C.CH<sub>2</sub>.CMe<sub>2</sub> (III) or Ph<sub>2</sub>CMeCMe:CH<sub>2</sub> (IV). Both HO- and Cl-products of

types I and II were treated to split off H<sub>2</sub>O and HCl, resp. In each case, the same product appeared to be obtained, identical with the hydrocarbon III (or IV), m. -14 to -12°, b<sub>10</sub> 150°. Values of *d*, *n*<sub>D</sub>, and [*M*]<sub>D</sub>, are also given to prove the identity of these variously produced products. R. seems to prefer formula III as best representing the facts (although the figures agree a little better with IV.—ABSTL.).

BEN H. NICOLET

**Ketocineole. V.** GUIDO CUSMANO. *Gazz. chim. ital.* 53, 195-200 (1923).—In preceding papers (*C. A.* 6, 1138, 14, 189; 3476; *Atti accad. Lincei* [5] 28, I, 79 (1919)), C. has shown that ketocineole (I) in spite of its relationship to the monocyclic ketoterpene (II) behaves like a bicyclic ketoterpene (camphor). The same distinction appears from the behavior of the  $\alpha$ -CO derivs. of the same compds. Thus camphorquinone is a yellow compd. that behaves exclusively like a diketone, while buccocamphor (the corresponding deriv. of menthone) is a colorless compd. that behaves like a ketol (III) more than like a diketone, has reducing properties, is sol. in alkalis and gives a  $\text{FeCl}_3$  reaction. The  $\alpha$ -CO deriv. of I, which C. calls *diketocineole* (IV), is a yellow volatile compd. that reacts solely like a diketone and is therefore assigned a constitution similar to that of camphorquinone (V). IV was prepared by exactly the same process used in the original prepn. of V. *Isonitrosoketocineole* (VI) was prepd. from I in  $\text{Et}_2\text{O}$  with  $\text{EtONO}$  and Na, or with  $\text{EtONO}$  and HCl. Usually but one of these methods,



developed by Claisen and Manasse, is successful but both worked with I and the details are given. VI in  $\text{EtOH-H}_2\text{O}$  with  $\text{PhNHNH}_2 \cdot \text{HCl}$  gave *diketocineole oxime phenylhydrazone*, m.  $186^\circ$ . VI treated similarly with  $\text{NH}_4\text{OH} \cdot \text{HCl}$  gave *diketocineole dioxime* (VII),  $195^\circ$  (decompn.). The mother liquors gave another compd., m.  $180^\circ$ , which at temps. above  $160^\circ$  solidifies and m. again at  $195^\circ$  (decompn.), showing that it is an isomer of VII analogous to that of camphorquinone dioxime. Attempts to obtain IV from this isomer gave only the *anhydride of the dioxime or furazan*, m.  $89^\circ$ . IV was obtained from VI by the process of Lapworth and Chapman by heating VI in  $\text{AcOH}$  with 3 times its wt. of  $\text{NaHSO}_4$  and decomp. the product by boiling with  $\text{HCl} + \text{dil. H}_2\text{SO}_4$ , neutralizing most of the acid and extg. with  $\text{Et}_2\text{O}$ . IV solidifies slowly, does not reduce Fehling soln. nor  $\text{NH}_4\text{OH-Ag}_2\text{O}$ , does not react with  $\text{FeCl}_3$  and gives VII with  $\text{NH}_4\text{OH} \cdot \text{HCl}$ . IV oxidized with 2%  $\text{KMnO}$  gives cineolic acid.

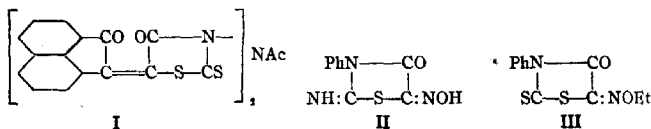
E. J. WITZEMANN

**Color and chemical constitution. XVI.** Further miscellaneous observations. JAMES MOIR. *Trans. Roy. Soc. S. Africa* 10, 233-7 (1922).—In this paper are given the absorption wave lengths of all the "monocyclic" and "dicyclic" dyes which were used in establishing M.'s theory of the color of "cyclic" colored substances (cf. *C. A.* 15, 1713; 16, 2996). 2,4'-Dihydroxybenzohydrol has  $\lambda$  543 in alkali,  $\lambda$  486 in  $\text{HCl}$ , and  $\lambda$  495 in water suspension. The 4,4'-isomeride has  $\lambda$  539 in dil. alkali but in acid is the same as the 2,4'-compd. 2-Hydroxy-4'-dimethylaminobenzohydrol has  $\lambda$  561 (broad) in alkali,  $\lambda$  500 in acid; the 4,4'-compd. has  $\lambda$  572 in alkali and  $\lambda$  504 in acid. 2,4,4'-Trihydroxybenzohydrol has  $\lambda$  494 instead of the expected  $\lambda$  550. 2,4-Dihydroxy-4'-methoxybenzohydrol has  $\lambda$  380 in alkali and appears to be monocyclic; 2,4-dihydroxy-3',4'-dimethoxybenzohydrol-2'-carboxylic acid is also monocyclic, with  $\lambda$  390 in alkali and so is mono- $\alpha$ -naphtholphthalein, from phthalaldehydic acid and  $\alpha$ -naphthol, with  $\lambda$  370. The C-Ph deriv. of the last-named has  $\lambda$  401 in alkali, but  $\lambda$  543 in strong  $\text{H}_2\text{SO}_4$ . The hydrol from  $p\text{-HOC}_6\text{H}_4\text{CHO}$  and  $\alpha$ -naphthol is violet with  $\lambda$  590, while that from  $\beta$ -naphthol is pink,  $\lambda$  556 in alkali. Phenol- $\beta$ -naphtholphthalein has  $\lambda$  570. The following show differences in  $\text{NaOH}$  (1) and  $\text{NaHCO}_3$  (2), resp.: 3-hydroxyphenolphthalein  $\lambda$  556 (1) and  $\lambda$  562 (2); 3,6-dihydroxyphenolphthalein,  $\lambda$  549 (1) and  $\lambda$  563, (2); 4,6-dihydroxyphenolphthalein,  $\lambda$  558 (1) and  $\lambda$  568 (2). 5-Methoxyphenolphthalein has  $\lambda$  565, while the 3,6-, 4,5-, and 5,6-dimethoxyphenolphthaleins have  $\lambda$  568,  $\lambda$  556, and  $\lambda$  571, resp. Other phenolphthalein derivs. examd. were: 3-nitro-,  $\lambda$  570; *abcd*-tetrachloro-,  $\lambda$  597 (cf. *C. A.* 17, 2283, for nomenclature); 5-nitro-,  $\lambda$  572; *abcd*-tetrachloro-,  $\lambda$  581. Phenoldimethyl- $\alpha$ -naphthylaminophthalein is green,  $\lambda$  625. The following derivs. of Ghosh's quinoline acid were examd.: phenolquinolinein,  $\lambda$  633; *o*-cresolquinolinein,  $\lambda$  544; thymolquinolinein,  $\lambda$  593; resorcinolquinolinein,  $\lambda$  490; orcinolquinolinein,  $\lambda$  496. In the  $\text{PhCOH}$  series the following are given: *o*-hydroxymalachite-green,  $\lambda$  627 neutral,  $\lambda$  572 in alkali,  $\lambda$  505 in acid; 2'-hydroxy-4-dimethylaminofuchsone,  $\lambda$  490 neutral,  $\lambda$  533 in alkali,  $\lambda$  479 in acid; *p*-methoxymalachite-green,  $\lambda$  605; *p*-methoxybenzaurine,  $\lambda$  551; *p*-nitromalachite-green,  $\lambda$  642; *p*-aminomalachite-green,  $\lambda$  581 in  $\text{AcOH}$ . Values are also given for a considerable no. of unclassified colored substances.

J. S. C.

**Preparation and properties of 4',4'-tetramethyldiaminoanthrafuchsone.** F. A. MASON. *J. Chem. Soc.* 123, 1546-59 (1923).—4',4'-*Tetramethyldiaminoanthrafuchsone* (I), bright red needles, m. 264-5°, is obtained in yields of 62% by adding anthrone in  $C_6H_6$  to Michler's ketone and  $POCl_3$  in hot  $C_6H_6$  and boiling for 20 hrs. *Acid HCl salt*, pale yellow, which readily hydrolyzes in moist air. *Benzoic acid chloride* (II), bronze-yellow, by the action of  $BzCl$  upon the base in  $C_6H_6$ . The deep blue aq. soln. dyes silk, wool and tannin-mordanted cotton a bright greenish shade of blue, which darkens on prolonged boiling owing to gradual hydrolysis. Addn. of  $Na_2CO_3$  to the blue soln. changes it gradually to a purple and violet-black flakes are pptd., the blue color being restored by  $AcOH$ . *Acetic ester chloride*, brilliant red, metallic leaflets, m. 240-2° (decompn.). It dyes fabrics the same shades as the  $Bz$  deriv. *p-Nitrobenzoyl ester chloride*, purplish black, m. 186-8° (decompn.). *Toluene-p-sulfonyl ester chloride*, purplish black. Fuming  $H_2SO_4$  acts upon I to give a very sol. product, which forms red salts, but is devoid of tinctorial powers.  $H_2SO_4$  acts upon II in 2 ways: it either hydrolyzes the  $Bz$  group with or without subsequent sulfonation or it may effect simple sulfonation of II to give a product forming a deep blue salt, which has the character of an acid dye but which is turned violet by alkalis. A comparison is given of the color of solns. of I, tetramethyldiaminofuchsone and naphthofuchsone in various solvents. The products are obviously of little if any use as coloring matters. C. J. WEST

**Rhodanines.** II. CH. GRÄNACHER, H. REIS AND E. POOL. *Helvetica Chim. Acta* 5, 382-91 (1922); cf. C. A. 14, 1667.—*Phenylrhodanine red*, fuchsine-like powder with green shimmer, results by the oxidation of *N*-phenylrhodanine with  $FeCl_3$  in  $AcOH$ ; it is purified through the reduction product, which is insol. in concd.  $Na_2S_2O_4$ . *N-Phenylrhodanine- $\alpha$ -acenaphthenequinone*, from mol. amts. of the constituents, orange-red needles. It is not reduced by alk.  $Na_2S_2O_4$  in the cold but on warming decompn. occurs. The *nitro deriv.* is yellow and m. 342° (decompn.). The *rhodanine complex* forms light red needles, and crysts. from  $C_6H_6N$  as brown-red needles contg. 1 mol.  $C_6H_6N$ . *Iminoacetyl-di-N,N-rhodanine- $\alpha$ -acenaphthenequinone* (I), brick-red leaflets, by heating aminorhodanine and acenaphthenequinone in  $AcOH$ . In  $AmOH$  the free *imino compd.* results as dark red felt-like needles. The action of  $AmNO_2$  upon phenylrhodanine in warm alc.  $HCl$  gives  *$\alpha$ -isonitroso-N-phenylrhodanine* (II),  $C_{16}H_{13}O_2N_3$ ,  $MeOH$ , golden yellow; the  $MeOH$  is lost at 100° and the compd. then m. 181°. The *Ag salt* ppts. in a yellowish brown form, which soon changes to a red-orange modification if in dil. alc., but is stable in abs. alc. With  $EtI$  the *Ag salt* yields the  *$\alpha$ -ethoxime deriv.* (III), yellow-



orange, m. 130°. II in  $AcOH$  with cold concd.  $HNO_3$ , gives the  *$\alpha$ -nitro deriv.*, bright yellow, m. 207° (decompn.).  *$\alpha$ -Isonitrosorhodanine*, yellow needles with  $3H_2O$ , m. 151-3°. The *Ag salt* is much more unstable than that of II. When reduced with  $Zn$  dust, the  $AcOH$  soln. quickly turns dark and a violet  $Zn$  salt ppts. The free acid could not be isolated because of decompn.  *$\alpha$ -Isonitroso-N-phenylthiohydantoin* (IV), pale yellow, m. 199-200°, results from phenylthiohydantoin and  $AmNO_2$ ; it forms with  $C_6H_6N$  or  $C_6H_5N$  addn. compds. which are decompd. by gentle heating. C. J. WEST

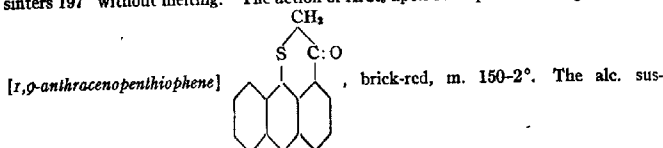
**Hydroxynaphthoic acids.** I. F. A. ROYLE AND J. A. SCHEIDLER. *J. Chem. Soc.* 123, 1641-7 (1923).—The  $HOC_{10}H_6CO_2H$  were prepd. by diazotization of the corresponding  $SO_3H$  acids, introduction of the  $CN$  group and hydrolysis with 10%  $KOH$ , followed by fusion with  $KOH$ . *Na 1-carboxynaphthalene-3-sulfonate*, needles with  $1H_2O$ . *K 6-sulfonate*, needles with  $2H_2O$ . *K 7-sulfonate*, needles with  $2H_2O$ . *6-Hydroxy- $\alpha$ -naphthoic acid*, m. 208-9° (the  $\gamma$ -acid of Stumpf, *Ann.* 188, 1);  $FeCl_3$  gives a dark brown color; dil.  $EtOH$  solns. show a green fluorescence. *Ac deriv.*, m. 209-10°; *anilide*, m. 193-4°. *7-Hydroxy acid*, m. 253-4°. *Ac deriv.*, m. 221-2°; *anilide*, m. 200-10°. (This is the  $\beta$ -acid of Battershall, *Ann.* 168, 144.) *3-HO acid*, m. 242-3°. The  $FeCl_3$  coloration is reddish brown and the fluorescence of the dil.  $EtOH$  soln. of the  $Na$  salt is purple. *Ac deriv.*, m. 169-70°; B.'s  $\alpha$ -acid is the 5-HO acid, which m. 235-6°, not 219°. Sulfonation of  $\alpha$ - $C_{10}H_7CO_2H$  by heating with 3 mols. 98%  $H_2SO_4$  for 8 hrs. produces a mixt. of 5-, 6- and 7-sulfo- $\alpha$ -naphthoic acids. C. J. WEST

**Mobility of symmetrical triad systems.** II. The conditions relating to systems terminated by the *o*-phenylene group. Derivatives of indene. C. K. INGOLD AND

H. A. PIGGOTT. *J. Chem. Soc.* 123, 1469–1509 (1923); cf. *C. A.* 17, 547.—In addition to the symmetry and fission tests which were used in the discussion of the mobility of systems, a third (substitution test) is now added. This is proof that a single individual behaves as if it were a mixt. of 2 forms by giving 2 isomeric substances such as  $C_6H_4MeNRN:NPh$  and  $PhNRN:NC_6H_4Me$ , when the mobile H atom is replaced by an alkyl or acyl group. In extending the work a study was made of aziminobenzene, benzimidazole, isindole and indene, the present work covering only indene, since the first 2 are covered by work already done and unexpected difficulties were met in the synthesis of isindole. The results show that the 3-C system in the indene nucleus is a mobile system, and, since it satisfies the test of symmetry, of substitution, and in all probability that of fission also, it must be regarded as in every way comparable with the mobile system present in the first 2 compds. *6-Nitro-1-hydrindamine* (I), m. 60–1°, is obtained by gradually stirring 11 g. 1-hydrindamine nitrate into 25 cc. concd.  $H_2SO_4$  at –5° to 0° (35 min.). *Ac deriv.*, m. 180°, is obtained from I and  $Ac_2O$  or by the nitration of *acetylhydrindamine*, m. 120°. Reduction of I with  $SnCl_2$  and HCl gives *6-amino-1-hydrindamine*, characterized as the *di-Ac deriv.* (II), m. 225°. Nitration of 1-hydrindone gives a mixt. of the 6- and 4- $NO_2$  derivs., sep'd. by fractional crystn. from petrol. ether. *6-Nitro-1-hydrindone* (III), m. 74°, is the less sol. form. It is decomp'd. by alkalis on standing in the cold or almost immediately on warming. The concd.  $H_2SO_4$  soln. is yellow, and III is pptd. unchanged if  $H_2O$  is added at once, but on standing it is transformed to an insol. substance probably of the anhydrobishydrindone type. *Oxime* (IV), m. 193–5°. Boiling 10% HCl regenerated the ketone. *Semicarbazone*, decomp. about 240°. Soln. in 10% HCl likewise regenerated III. *2,2-Di-Br deriv.* (V), m. 112°. Oxidation with alk.  $KMnO_4$  gives 4-nitrophthalic acid. *2-Oximino deriv.*, m. about 240° (decompn.), from III, iso- $AmNO_2$  and HCl, in 80–90% yield. Alkalies give deep purple solns. rapidly turning brown. Suspended in 40% HCHO and treated with HCl, *6-nitro-1,2-diketohydrindene*, pale orange-brown, decomp. about 160°, results in 70–80% yield. Oxidation gives 4-nitrohomophthalic acid. *6-Amino-1-hydrindone* (VI), deep yellow, m. 171°, was prep'd. by reduction of the crude nitration product, III or V with  $SnCl_2$  and HCl, or of IV with Zn dust and  $AcOH$  or by adding Sn to IV in 20% HCl. Dil. solns. in  $EtOH$  or  $Et_2O$  have a marked green fluorescence. *Ac deriv.*, (VII) m. 178°. *Semicarbazone*, decomp. without melting.  $NH_4OH.HCl$  and VII give *6-acetylamino-1-hydrindoxime*, m. 225–8°, which is reduced by Na-Hg in dil.  $AcOH$  to *6-acetylamino-1-hydrindamine* (VIII),  $C_{11}H_{11}ON_2.2H_2O$ , m. 65°; anhyd., pale yellow, m. 160°. The *Ac deriv.* is identical with II. VIII, with  $MeOH.KOH$  and  $MeI$ , gives *6-acetylamino-1-hydrindyltrimethylammonium iodide*, m. 201°, from which the *hydroxide* is produced by the action of  $Ag_2O$ . On heating, this yields a small amt. of *acetylaminoindene*, m. 135°. *6-Hydroxy-1-hydrindone* (IX), yellow, m. 151–3°, results by heating the diazo comp'd. from VI at 100°. It gives a violet color with  $FeCl_3$ . *6-MeO deriv.*, bright yellow, m. 109°, in 80% yield by the use of  $Me_2SO_4$ . *6-Methoxy-1-hydrindoxime*, pale yellow, m. 133°, by the use of  $KOH$ . If excess of  $Na_2CO_3$  is used a bright yellow *mol. comp'd.*, m. 90°, of the ketone and oxime is obtained; this could not be resolved by fractional crystn. but boiling alkali and  $NH_4OH$  converted it into the oxime. Reduction of the oxime gave *6-methoxy-1-hydrindamine* (IXA), analyzed as the *HCl salt*, m. 250° (decompn.). *Ac deriv.*, m. 130°. The 2nd product of nitration of 1-hydrindone is a *mol. comp'd.*, m. 77°, of III and the 4- $NO_2$  deriv. (X). It could not be resolved by fractional crystn. or by allowing the fused mass slowly to solidify and sepg. the crystals from time to time. The *oxime* (XI), m. 181°, gave the ketone, m. 77°, on treatment with 10% HCl, as did the *semicarbazone*, decomp. on heating. *p-Nitrophenylhydrazones*, yellow, decomp. above 200°. *2,2-Dibromo-4-nitro-1-hydrindone* (XII), m. 140°, is obtained by bromination of X and fractional crystn. from  $EtOAc$ , it being considerably less sol. than V. *4-Amino-1-hydrindone* (XIII), yellow, m. 125°, is obtained upon reduction of the crude nitration products of X, XII or XI, it being more sol. than VI. Homophthalic acid (XIV), may be prep'd. conveniently in large quantities by the oxidation of 1-hydrindone with  $CrO_3$ . *4-Nitro deriv.* (XV), m. 220°, is obtained by direct nitration of XIV, or by oxidation of III, X or 6-nitro-1,2-diketohydrindene with  $CrO_3$ . *Me ester*, m. 92–5°. Oxidation of XV gave 4-nitrophthalic acid, also prep'd. by oxidation with alk.  $KMnO_4$  of III, X or V. Oxidation of XII with alk.  $KMnO_4$  gave 3-nitrophthalic acid. *m-Acetylaminocinnamic acid*, m. 237°. *m-Hydroxycinnamic acid*, pale buff, m. 191°, may be prep'd. from the  $NO_2$  acid without isolation of the  $NH_2$ -acid. *m-Methoxy- $\beta$ -phenylpropionyl chloride*, light yellow oil,  $b_p$  165°.  $AlCl_3$  gives *5-methoxy-1-hydrindone* (XVI), m. 110° (*semicarbazone*, m. 239°), and the 5- and 7-hydroxy-1-hydrindones. *Oxime* of XVI, m. 151°, is reduced by Na-Hg in 50%  $AcOH$  to *5-methoxy-1-hydrindamine* (XVII), analyzed as the *HCl*

salt, m. 230°, and *Ac deriv.*, m. 135°. *p*-Nitro- $\beta$ -phenylpropionyl chloride, br 204°; the action of  $\text{AlCl}_3$  in  $\text{SOCl}_2$  gave about 15% *p*-nitro- $\beta$ -phenylpropaldehyde, m. 108° (*oxime*, m. 102–1°), the constitution of which was proved by oxidation with 30%  $\text{CrO}_3$  to  $p\text{-O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{CO}_2\text{H}$  and  $p\text{-O}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ . 5(6)-Methoxyindene (XVIII), prep. from IXA or XVII by distn. of the  $\text{HCl}$  salt,  $b_{745}$  236° (yield, 80%). *Picrate*, deep red, m. 64°. *Di-Br deriv.*, m. 100–1°. Oxidation of XVIII with  $\text{CrO}_3$  gave 5-methoxyhomophthalic acid, m. 222° (temp. depends upon rate of heating, varying between 218–27°), 4-methoxyphthalic acid, and an easily sol. acid which was not identified. The same products were obtained upon oxidation of XVII in 70 and 15% yields. 5(6)-Methoxy-1-benzylidene-3,  $\alpha$ -hydroxybenzylidene, lemon-yellow, m. 128°, is obtained from XVIII and  $\text{BzH}$  by condensation with  $\text{EtONa}$ . Piperonal gives 5(6)-methoxy-1-piperonylideneindene, which exists as a lemon-yellow form, m. 148°, which is less sol. in  $\text{C}_6\text{H}_6$ , and an orange-yellow form, m. 142°, as well as 5(6)-methoxy-1-piperonylidene-3- $\alpha$ -hydroxypiperonylidene, canary-yellow, m. 162–3°. The less fusible isomer appears to be present in small amts. only.

*C. J. WEST*  
Action of sulfur chloride upon anthracene. P. FRIEDLÄNDER AND A. SIMON. *Ber.* 55B, 3969–80 (1922).—Fifty g.  $\text{C}_{14}\text{H}_{10}$  and 60–65 g.  $\text{S}_2\text{Cl}_2$  give a 90% yield (70 g.) of anthryl-*g*-dithiochloride (I),  $\text{C}_{14}\text{H}_8\text{S}_2\text{Cl}_2$ , yellowish red, m. 117–8°;  $\text{H}_2\text{O}$ -contg. solvents quickly decomp. it.  $\text{NH}_3$  and aromatic bases readily react but give only yellowish red resins. An exception is  $\text{Me}_2\text{NH}$ , which gives *g*-anthryldithiodimethylamine, yellow prisms, m. 70–1°. I, shaken with a concd. aq.  $\text{Na}_2\text{SO}_3$  at room temp., gives *g*-anthrylthiosulfuric acid (II),  $\text{C}_{14}\text{H}_8\text{S}_2\text{SO}_3\text{H}$ , the *Na* salt of which is yellow. *Ba salt*, citron-yellow. The action of 140 g. cryst.  $\text{Na}_2\text{S}$  in 520 cc.  $\text{MeOH}$  upon 45 g. I gives *g*-anthrylmercaptan (III),  $\text{C}_{14}\text{H}_8\text{SH}$ , m. 90–1°, the dil.  $\text{AcOH}$  soln. has a strong blue fluorescence, which gradually disappears because of oxidation to the disulfide, orange red, m. 233°, best carried out in alk. soln. with  $\text{K}_2\text{Fe}(\text{CN})_6$ ; this also results by heating II with concd.  $\text{HCl}$ . III condenses with  $\text{ClCH}_2\text{CO}_2\text{H}$  in alk. soln. to give anthryl-*g*-thioglycolic acid, pale yellow, m. 164°. *Me ester*, yellow, m. 67°. Chloride (IV), yellow needles. *Amide*, sinters 197° without melting. The action of  $\text{AlCl}_3$  upon IV in petrol. ether gives 1-keto-



pension yields a red soln. upon addn. of alkali, but in contact with the air it turns bluish green and then ppts. amorphous flakes. Alk. reducing agents give a colorless leuco base, at once oxidized by the air. Oxidation gives bis-[*g*-anthracenopenthiophene]-indigo, dark green needles, while condensation with  $\alpha$ -isatin anilide yields [anthracenopenthiophene]-indole-indigo, dark needles.

*C. J. WEST*  
The diazonium hydroxides of anthraquinone. M. BATTEGAY AND J. BÉHA. *Bull. soc. ind. Mulhouse* 89, 241–6 (1923).—Diazonium salts of anthraquinone were prep. by Hantzsch's method (H. and Reddelien, "Die Diazoverbindungen," 1921). The  $\alpha$ - and  $\beta$ -acid sulfates of anthraquinone are easily prep. pure, and are remarkably stable, both dry and in aq. soln. Titrated with  $\text{Ba}(\text{OH})_2$  in the presence of  $\text{Me}$  orange they can be quant. changed into  $\text{Ba}$  salts:  $2\text{C}_{14}\text{H}_7\text{O}_2\text{N}(\text{N})\text{OSO}_3\text{H} + \text{Ba}(\text{OH})_2 = (\text{C}_{14}\text{H}_7\text{O}_2\text{N}_2\text{OSO}_3)_2\text{Ba} + 2\text{H}_2\text{O}$ . Addn. of an equal amt. of  $\text{Ba}(\text{OH})_2$  causes quant. sepn. of  $\text{SO}_3$ :  $(\text{C}_{14}\text{H}_7\text{O}_2\text{N}_2\text{OSO}_3)_2\text{Ba} + \text{Ba}(\text{OH})_2 = 2\text{C}_{14}\text{H}_7\text{O}_2\text{N}_2\text{OH} + 2\text{BaSO}_4$ , and in the cold (0°) the soln. is decidedly alk. to litmus,  $\text{Me}$  orange, thiazole paper and Dobbin's reagent. The soln. is very unstable ( $\alpha$ -diazonium hydroxide less so than the  $\beta$ -hydroxide), becoming acid in a few min., apparently according to the reaction:  $\text{C}_{14}\text{H}_7\text{O}_2\text{N}(\text{N})\text{OH} \longrightarrow \text{C}_{14}\text{H}_7\text{O}_2\text{N}:\text{NOH}$ . The acid soln. can still be coupled with  $\alpha$ -naphthol, but much more slowly than the fresh alk. liquor. Pptn. by means of  $\text{H}_2\text{PtCl}_6$  or  $\text{Na}_2\text{PtCl}_6$  of the diazonium base gave a salt identical with that obtained by pptn. of the corresponding sulfate, showing conclusively that the diazonium cation had been pptd. *Na cobaltinitrite* acts similarly to  $\text{H}_2\text{PtCl}_6$ .

*A. PAPINBAU-COUTURE*  
Dyes derived from phenanthraquinone. III. Phenanthriminazoles. A. C. SIRCAR AND G. C. SIRCAR. *J. Chem. Soc.* 123, 1559–65 (1923); cf. *Ibid* 37, 661; 39, 225; 41, 146.—Derivs. of  $\alpha$ -phenylphenanthriminazole have been prep. by dissolving the quinone and aldehyde in hot  $\text{AmOH}$  and passing a current of dry  $\text{NH}_3$  through the well stirred soln. or by heating the mixt. of quinone, aldehyde and concd.  $\text{NH}_3$  under pressure for 3–4 hrs. 3'-Nitro deriv., from phenanthraquinone (I) and  $m\text{-O}_2\text{NC}_6\text{H}_4\text{CHO}$

by the alc. method, yellow, m.  $240^{\circ}$  (decompn.). *7,8(7)-Dibromo-3'-nitro deriv.*, yellow, does not m.  $280^{\circ}$ , from dibromophenanthraquinone (II) and  $m\text{-O}_2\text{NC}_6\text{H}_4\text{CHO}$ . Conc'd.  $\text{H}_2\text{SO}_4$  gives a grass-green soln. *5,10-Dibromo-3'-nitro deriv.*, yellow, does not m.  $280^{\circ}$ .  $\text{H}_2\text{SO}_4$  gives a bottle-green color; wool is dyed a yellowish brown shade. *5-Bromo-3'-nitro deriv.*, yellow, m.  $280^{\circ}$  (decompn.). *3'-Nitro-5,10-diamino deriv.*, brown, does not m.  $285^{\circ}$ .  $\text{H}_2\text{SO}_4$  gives a brownish red soln. It dyes unmordanted wool terra-cotta and chrome-mordanted wool brown. *3'-Nitro-7,8-diamino deriv.*, by the autoclave method. *3'-Nitro-5-amino deriv.*, light brown, m. above  $285^{\circ}$ , by the autoclave method. Conc'd.  $\text{H}_2\text{SO}_4$  gives blood-red solns., and wool is dyed in brown shades. *3'-Nitro-7,8-dihydroxy deriv.*, does not m.  $290^{\circ}$ ; chrome-mordanted wool is dyed buff. *3'-Nitro-5,10-dihydroxy deriv.*, dyes chrome-mordanted wool deep brown. *7,8(7)-Dibromo-4'-nitro deriv.*, yellow, m.  $252^{\circ}$  (decompn.), from II and  $p\text{-O}_2\text{NC}_6\text{H}_4\text{CHO}$  by the alc. method. It dyes wool yellow shades. *5'-Bromo-2'-hydroxy deriv.*, m.  $267^{\circ}$ , from I and 5,2-Br-(OH) $\text{C}_6\text{H}_3\text{CHO}$ ; conc'd.  $\text{H}_2\text{SO}_4$  gives a blue soln. *5',7,8(7)-Tribromo-2'-hydroxy deriv.*, straw-white, does not m.  $285^{\circ}$ .  $\text{H}_2\text{SO}_4$  gives a bluish green color. *3',5',7,8(7)-Tetra-bromo-4'-hydroxy deriv.*, m.  $275^{\circ}$  (decompn.).  $\text{H}_2\text{SO}_4$  gives a green soln. *3'-Nitro-7,8-dianilino deriv.*, does not m.  $285^{\circ}$ , is prep'd. by boiling the di-Br deriv. with  $\text{PhNH}_2$ , and a little Cu powder; the  $\text{H}_2\text{SO}_4$  soln. is green and wool is dyed in green shades. *3'-Nitro-5,10-dianilino deriv.*, does not m.  $290^{\circ}$ . *3'-Nitro-5-anilino deriv.*, bluish green;  $\text{H}_2\text{SO}_4$  gives a dark green soln. Wool is dyed in ash-colored shades. *4'-Nitro-7,8(7)-dianilino deriv.*, gives a reddish-brown color in  $\text{H}_2\text{SO}_4$  and dyes wool in leather-brown shades and chrome-mordanted wool in yellowish brown shades. *5'-Anilino-2'-hydroxy deriv.*, bluish violet, giving a dark green soln. in conc'd.  $\text{H}_2\text{SO}_4$  and dyeing wool in maroon shades. *5',7,8(7)-Trianilino-2'-hydroxy deriv.*, gives a dark green soln. in conc'd.  $\text{H}_2\text{SO}_4$ , colors wool in chocolate shades and chrome-mordanted wool in maroon shades. *3',5',7,8(7)-Tetraanilino-4'-hydroxy deriv.*, dyes wool in bluish black shades and chrome-mordanted wool in bluish green shades. Although almost insol. in  $\text{H}_2\text{O}$ , these derivs. when freshly ppt'd. from conc'd.  $\text{H}_2\text{SO}_4$  solns. are fairly well adapted for dyeing on wool.

C. J. WESS

So-called fufural reaction of sake and soy. SHINTARO KODAMA. *J. Chem. Soc. Japan* 43, 949-56(1922).—A volatile fraction (I),  $b_p$   $60\text{--}2^{\circ}$ , which is responsible for the typical soy odor gives all so-called fufural reactions when tested with  $\text{PhNH}_2$ , acetate or chloride,  $\beta\text{-C}_{10}\text{H}_7\text{NH}_2$  and picric acid,  $\alpha$ -naphthol and  $\text{H}_2\text{SO}_4$ , phloroglucinol and HCl and  $\text{PhNHNH}_2$  and HCl. Since this substance is shown to be not fufural but another aldehyde (see following abstr.), a positive test with so-called fufural reactions will not always indicate the presence of fufural in soy. Since various aldehydes are used in giving an aromatic odor to soy, their reaction with these agents was tried. With  $\beta\text{-C}_{10}\text{H}_7\text{NH}_2$  and picric acid, soy aldehydes give a red while all the others give a yellow color. On the basis of these expts. K. states that the presence of fufural in sake, beer and wine cannot be ascertained by the  $\text{PhNH}_2\text{AcOH}$  reaction alone.

S. T.

Chemistry of aldehydes. IV. Some new aldehydes in soy. SHINTARO KODAMA. *J. Chem. Soc. Japan* 43, 956-81(1922); cf. *C. A.* 16, 1932.—By distn. of soy, two new ketoaldehydes, ( $\text{C}_8\text{H}_6\text{O}_2$ ) (I), and ( $\text{C}_8\text{H}_6\text{O}_2$ ) (II), were isolated. I. The fraction  $b_p$   $60\text{--}2^{\circ}$  has a typical soy odor, by which 1 part in 100 million of air can be detected. It gives a Ag mirror with  $\text{NH}_3\text{-Ag}$  soln., decolorizes Br, but forms no cryst.  $\text{NaHSO}_4$  compd. With  $\text{PhNHNH}_2\text{AcOH}$  or  $p\text{-BrC}_6\text{H}_4\text{NHNH}_2\text{AcOH}$ , ice-cold aq. soln. gives milky oily substances, changing from red to blackish tannin-like substances. It gives no  $\text{FeCl}_3$  test, nor a pyrolyse reaction with alc.  $\text{NH}_3$ . Of the 3 known aldehydes and ketones, of the compn.  $\text{C}_8\text{H}_6\text{O}_2$ ,  $\alpha$ - and  $\beta$ -angelic lactones are ruled out by cold weak alkali treatment, which showed no lactone O, and  $\alpha$ -diketopentamethylene by m. p. and b. p. differences.  $\text{Ag}_2\text{O}$  oxidizes it to  $\beta$ -acetylacrylic acid. The index of refraction shows the presence  $\text{O}:\text{C}:\text{C}:\text{C}:\text{O}$ . With  $\text{N}_2\text{H}_4\cdot\text{H}_2\text{O}$  or  $\text{PhNHNH}_2$ , pyridazine derivs. are obtained. With  $\text{AcCO}_2\text{H}$  and  $\beta\text{-C}_{10}\text{H}_7\text{NH}_2$ ,  $\beta$ -naphthochinonic acid, m.  $262\text{--}3^{\circ}$ , is obtained. From these fact, the formula  $\text{AcCH}:\text{CHCHO}$  is given to I. II. The fraction  $b_p$   $79^{\circ}$  has a much more intense soy bean odor than I. In every respect, it gives tests identical with those obtained with I, but from its compn. it is a higher homolog of I. Whether it is (1)  $\text{EtCOCH}:\text{CHCHO}$ , (2)  $\text{AcCMe}:\text{CHCHO}$ , (3)  $\text{AcCH}:\text{CMeCHO}$  or a mixt. is not yet det'd. The chemistry of formation of  $\text{C}_8\text{H}_6\text{O}_2 - 4\text{O}$  from carbohydrates and proteins by fermentation is discussed. For the fufural reactions of these two new ketoaldehydes see preceding abstr.

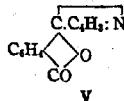
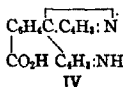
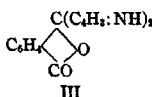
S. T.

Syntheses by means of pyrrolmagnesium bromide. XIV. Pyrrolephthalein. BERNARDO ODDO and FRANCESCO TOGNACCHINI. *Gazz. chim. ital.* 53, 265-70(1923).—The various known condensation products of  $\text{C}_4\text{H}_4(\text{CO})_2\text{O}$  with phenols, aminophenols,



pyridine, quinoline and pyrrole are reviewed. The results here described relate to the prepn. of disubstituted pyrrolic derivs. of phthalide obtained by the action of phthalyl chloride (I),  $C_6H_4(CClO.CO)$ , on pyrrolylmagnesium bromide (II),  $C_4H_5(MgBr):NH$ . II

(obtained from 4.8 g. Mg, 24 g. EtBr and 13 g. pyrrole) was added gradually to 20 g. I in 3 vols. of dry  $Et_2O$ . After 24 hrs. the soln. was treated with ice and neutralized with  $NaHCO_3$ . The  $H_2O-Et_2O$  layer was decanted. The remainder was treated with 50% EtOH at  $50^\circ$ . The soln. was neutralized with  $NaHCO_3$  and extd. with  $Et_2O$ , the ext. being combined with  $H_2O-Et_2O$  layer. This ext. was evapd. and gave a dense liquid from which cryst. *pyrrolephthalcin* (III), m.  $202^\circ$ , sepd. The aq. exts. were yellow and sepd. *pyrrolypyrrolenemethane-o-carboxylic acid* (IV), m.  $130^\circ$ . The acid soln. of III boiled in  $H_2O$  tars and gives a yellow soln. containing pyrrolenephthalide (V) which is formed by way

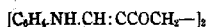


of IV. The m. p. of IV becomes  $153^\circ$  after some months (probably in consequence of internal neutralization) but is  $130^\circ$  after crystn. from  $H_2O$ . When a bit of Zn is added to IV in  $H_2O$  the yellow soln. becomes colorless. On adding  $FeCl_3$  the yellow color returns. The leuco deriv., *dipyrrolymethane-o-carboxylic acid* (analogous to the conversion of phenolphthalein (VI) into phthalin or dihydroxytriphenylmethane-o-carboxylic acid) is formed and on oxidation gives IV. O. has previously shown (C. A. 8, 84) that VI couples with diazonium compds., giving colored compds. contg. azoic groups. The same is true of III or rather IV, since the reaction takes place in alk. soln., giving products that are probably analogous to benzenebisazophenolphthalein, i. e., benzenebisazopyrrolephthalcin. These will be described in another paper. E. J. W.

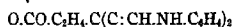
**Benzopyrylium salts of distyryl ketones. II. Salts and metallic complexes of 4'-dimethylamino-2-styrylbenzopyrylium.** J. S. BUCK AND I. M. HELLBRON. *J. Chem. Soc.* 123, 1395-404 (1923); cf. C. A. 16, 3080.—Owing to the presence of the  $Me_2N$  radical, which renders the pyrylium salts very sol. in acids, the free chloride could not be isolated in the solid state. Its formation is inferred from the color changes which take place on heating the ketone (0.25 g.) with concd. HCl, followed by subsequent diln., with  $H_2O$ : (the color and vol. of soln. are given): blood-red (cold), 10 cc.; golden yellow (after heating), 10; pale green, 12; intense emerald-green, 18; intense dark crimson, 50; intense red-violet, 150; pure violet, 300; blue with violet tint, 800; deep blue, 2500; intense royal blue, 3500; distinct blue, 10 $^4$ . These changes are probably due to the increasing ionization of the salt. With the iodide, complicated periodides are formed, to which definite formulas were not assigned. The *perchlorate* results by adding 20%  $HClO_4$  to the heated HCl soln., forms dark green prisms, m.  $207^\circ$ ; 70%  $HClO_4$  forms the *diperchlorate*, pale orange needles, exploding with extreme violence when heated. *Ferricyanide*, brilliant blue powder, sol. in concd.  $H_2SO_4$  with a yellow color and marked greenish yellow fluorescence. The *picrate* is obtained as a mixt. of bright green and almost black crystals, which are apparently interconvertible and could not be sepd. The color base of 4'-dimethylamino-2-styrylbenzopyrylium chloride is pptd. by the addn. of excess of  $K_2CO_3$  to a violet soln. of the chloride and forms dull green flocks; the EtOH soln. with AcOH gives a deep emerald color, with HCl a greenish blue color, both persisting on diln. Warmed with HCl, the EtOH soln. gives a deep green color, which becomes orange-red with excess of acid and gives a fine blue color on diln. The carbinol base is obtained by adding KOH to a suspension of the perchlorate in abs. EtOH as a pale yellow powder, sol. in glacial AcOH with an intense royal blue color. In cold concd. HCl the color is orange-yellow, becoming blue on high diln. Metallic complexes were prepd. by adding the proper salt to a heated soln. of the ketone in concd. HCl or HBr. They sep. in a pure condition, are stable in the dry state but decomp. fairly rapidly on exposure to moisture, yielding pure green solids with a lower Cl content. They are sol. in  $H_2O$ , giving deep violet solns., quickly changing to blue on diln.  $CuCl_2$  salt,  $C_{18}H_{15}ONCl$ .  $HCl.CuCl_2$ , ochre-colored, m.  $171-2^\circ$  (decompn.).  $CoCl_2$ , apple-green, m.  $214-5^\circ$ .  $CdCl_2$ , greenish yellow, m.  $218-20^\circ$ .  $ZnCl_2$ , golden, glistening needles, m.  $218^\circ$ .  $CdBr_2$ , ochre-colored, changes to orange at  $120^\circ$ , m.  $214-5^\circ$ .  $FeCl_3$ ,  $C_{18}H_{15}ONCl$ ,  $FeCl_3$ , bronze-green, glistening prisms, m.  $227^\circ$  (decompn.).  $SnCl_4$ ,  $C_{18}H_{15}ONCl.HCl$ .  $SnCl_4.H_2O$ , greenish yellow, m.  $224^\circ$ ; the  $H_2O$  appears to be lost at  $170^\circ$ , the crystals changing to a pale green. *Thallium chloride*, greenish black; the AcMe soln. is intense

blue, giving a violet ppt. with HCl, changing to green on further addn. of acid, while a large excess gives a yellow soln. C. J. WEST

**Synthesis of  $\gamma$ -diketones in the indole group.** G. SANNA. *Gazz. chim. ital.* 53, 177-82 (1923).—In extending the study of diketones of the indole group (C. A. 17, 1639), S. now describes the products obtained from  $(\text{CH}_2\text{COCl})_2$  (I) and the Mg derivs. of indole and  $\alpha$ -methylindole. Since I may also react in the



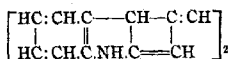
II



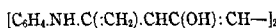
III

asym. form,  $\text{CH}_2\text{CH}_2\text{CCl}_2\text{O.CO}$ , it may react to give the  $\gamma$ -diketone (II) or the

lactone (III), or a mixt. of II and III. The results showed that II is formed, giving *diindolyethane* ( $\beta,\beta$ -*diindyl- $\gamma,\gamma$ -propanedione*) (IV) and *dimethylindolyethane* (V). Both IV and V react with  $\text{NH}_4\text{OH}$ , giving the corresponding dioximes, m. 306° (decompn.) and 267°, resp. On heating with alkalis in which they are insol. IV and V do not give HO acids corresponding to III.  $\gamma$ -Diketones readily give the reactive enol isomers. IV and V with  $\text{NH}_3$  in EtOH and in the sealed tube at 140-50° for 8 hrs. gave  $\alpha,\alpha',\beta,\beta'$ -*diindylpyrrole* (VI), m. 254°, and  $\alpha,\alpha',\beta,\beta'$ -*dimethylindylpyrrole* (VII), m. 237°, which will be more fully described in another paper. The Mg deriv. of indole, prep'd. as usual, was treated drop by drop with cooling with 0.5 mol. I in dry Et<sub>2</sub>O. The next day ice was added, the Et<sub>2</sub>O was eliminated, the soln. was neutralized with  $\text{Na}_2\text{CO}_3$  and the product was filtered off. Unchanged indole and a little tar were removed by extg. with a little boiling EtOH. The IV, m. 287°. IV in alc. added to  $\text{AgNO}_3$  soln. (+ a few drops of  $\text{NH}_4\text{OH}$ ) ppts. a *Ag salt*,  $\text{C}_{20}\text{H}_{14}\text{O}_2\text{N}_2\text{Ag}$ . V, prep'd. similarly, m. 297° (decompn.) and gives a similar *Ag salt*. The main product in the action of V with  $\text{NH}_3$  was not VII but a comp'd. VIII,  $\text{C}_{22}\text{H}_{16}\text{N}_2$ , m. 285°. In this case V is thought to give IX, a methylene-



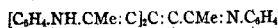
VIII



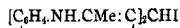
IX

indolenine deriv., by tautomerization and this by the loss of  $\text{H}_2\text{O}$  gives a new tetramethylene ring attached to the pyrrole ring, i. e., VIII. E. J. WITZEMANN

**Syntheses in the indole group. IX. Indyl dyes derived from methane.** BERNARDO ODDO AND FRANCESCO TOGNASCHINI. *Gazz. chim. ital.* 53, 271-5 (1923).—In a preceding paper O. and Binaghi (C. A. 16, 1392) reported results on the action of pyrrylmagnesium bromide on polyhalogenated derivs. of  $\text{CH}_4$  and  $\text{C}_2\text{H}_4$  in order to obtain pyrrylmethane and ethane hydrocarbons. O. and T. have now found that 2-methylindylmagnesium bromide (I) with  $\text{CHI}_3$  gives tri[methylindyl]methane (II), identical with that obtained by Ellinger and Flamand (C. A. 4, 2054; 5, 1906), which is the yellow leuco deriv. from which is formed by air oxidation  $\alpha$ -methylindolide-dimethylindylmethane (III), which dyes wool and silk. I also reacts with  $\text{CHI}_3$  giving  $\alpha$ -iododi[methylindyl]methane (IV), which then reacts with another mol. of I, giving  $\alpha$ -methylindole and

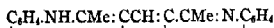


III



IV

$\alpha$ -methylindole- $\alpha$ -methylindolidenemethane (V). To 0.1 g. mol. magnesiummethylketole




V


in dry Et<sub>2</sub>O was added  $\frac{1}{20}$  mol.  $\text{CHI}_3$ . The mixt. after 30 hrs. on the  $\text{H}_2\text{O}$  bath was treated with ice- $\text{H}_2\text{O}$  sat'd. with  $\text{NH}_4\text{Cl}$ . The aq. layer with its solid suspension was sep'd. from the Et<sub>2</sub>O layer and filtered. The residue was washed with Et<sub>2</sub>O and then AcOEt and purified with difficulty by pptn. from MeOH with  $\text{H}_2\text{O}$ . The product (III), m. 231-3° (decompn.). From the mother liquor  $\text{C}_{12}\text{H}_{16}\text{N}_2$  (V), having the properties given by Koenig (C. A. 6, 74) was isolated. 1 g. V in 100 cc. 5% tartaric acid sep'd. the *tartrate*,  $\text{C}_{10}\text{H}_{14}\text{N}_2\text{C}_4\text{H}_4\text{O}_6$ , on standing 2 days. The *sulfate*,  $\text{C}_{10}\text{H}_{14}\text{N}_2\text{H}_2\text{SO}_4$ , was obtained similarly. E. J. WITZEMANN

Catalytic hydrogenation under pressure in the presence of nickel salts. V. The

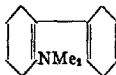
**carbazole complex.** JULIUS VON BRAUN AND HEINRICH RITTER. *Ber.* 55B, 3792-803 (1922); cf. C. A. 17, 1965; Padoa and Fabris (*Atti. accad. Lincei* 16, 1, 921-4 (1907)).—The process used by the authors does not cause the hydrogenation of pyrazole even at 260° and under a pressure of 30 atm., in spite of the use of a material which has been exhaustively purified in several different manners. Nevertheless, the authors are inclined to the view that pure pyrazole is not unusually resistant to hydrogenation, and that the failure of their expts. is due to some unknown catalytic impurity. The *N*-alkylcarbazoles are readily hydrogenated with initial addn. of 4 H atoms to one C<sub>6</sub>H<sub>5</sub> nucleus. Subsequently, the second C<sub>6</sub>H<sub>5</sub> nucleus is attacked with addn. of a further 4 atoms of H. 9-Methylcarbazole readily absorbs about 7 atoms of H at 210-15° and 25 atm. pressure. About 40% of the initial material remains unchanged while a portion is perhydrogenated with production of NH<sub>3</sub>. The liquid product of the reaction is a mixt. of the octahydro and tetrahydro derivs. with 9-methylcarbazole, from which the first-named is readily sepd. by treatment with HCl (20%) in which it alone dissolves. The remaining bases cannot be sepd. from one another by distn. or crystn.; the presence of the tetrahydro compd. is established by the formation of the strongly basic hexahydro deriv. when the mixt. of bases is treated with Sn and HCl. *g*-Methyloctahydro-

carbazole, MeN , m. 94°, b<sub>14</sub> 176-8°, is somewhat unstable towards air and does

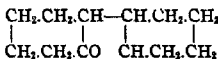
not give the pine-shaving or the Me<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>CHO reaction. It does not give a well defined picrate or methiodide; it is readily oxidized by KMnO<sub>4</sub> or FeCl<sub>3</sub>, but it has not yet been found possible to isolate uniform products of the action. It is conveniently

reduced by Sn and boiling HCl (20%) to *g*-methyloctahydrocarbazole, MeN ,

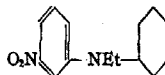
a mobile liquid, b<sub>12</sub> 138-9°, which is stable towards air; HCl salt, non-cryst. HBr salt, m. 202-4; picrate, m. 162°; methiodide, m. 189°. The presence of the double bond in the base is betrayed only by its instability towards KMnO<sub>4</sub>; it yields only the HBr salt when treated with fuming HBr and does not unite with Br or H even under widely varied conditions. The methiodide is transformed by successive treatment with Ag<sub>2</sub>O and distn. into 2-dimethylamino-Δ<sup>11'</sup>-dicyclohexenyl, an almost colorless liquid, b<sub>10</sub> 148°, which is conveniently characterized as the picrate, m. 157°. The new base is somewhat unstable and is readily converted by H<sub>2</sub>SO<sub>4</sub> (10%) into 2-Δ<sup>1</sup>-cyclohexenylcyclohexanone (II), b<sub>14</sub> 137-9°, d<sub>15</sub><sup>20</sup> 1.015, n<sub>D</sub><sup>15</sup> 1.515 (semicarbazone, m. 191°). The ketone is certainly not identical with the compd. obtained by Wallach (C. A. 5, 3280) by the autocondensation of cyclohexanone, and it would therefore appear that the latter has the alternative constitution, C<sub>6</sub>H<sub>9</sub>O: C<sub>6</sub>H<sub>9</sub>, suggested by Wallach. 2-Δ<sup>1</sup>-cyclohexenylcyclohexanone is readily reduced by H and PdCl<sub>2</sub> to 2-cyclohexylcyclohexanone, b<sub>11</sub> 135°, d<sub>4</sub><sup>16</sup> 0.987, n<sub>D</sub><sup>20</sup> 1.4915 (cf. Wallach, *loc. cit.*). The reduction of 9-ethylcarbazole



I



II



III

is very similar to that of the Me compd. *g*-Ethylloctahydrocarbazole, m. 43°, b<sub>10</sub> 162-3°, is unstable towards air; it does not give a methiodide or a picrate. It is readily reduced to *g*-ethyldecahydrocarbazole, a liquid stable towards air, b<sub>11</sub> 140-1°, HCl salt, non-cryst.; picrate, m. 133°; methiodide, m. 176-7°. 2-Methylethylamino-Δ<sup>11'</sup>-dicyclohexenyl is a liquid, b<sub>11</sub> 148-50°, which gives a non-cryst. picrate and methiodide. It is readily transformed by dil. H<sub>2</sub>SO<sub>4</sub> into 2-Δ<sup>1</sup>-cyclohexenylcyclohexanone and MeNHET. *g*-Ethylhexahydrocarbazole, b<sub>8</sub> 155-7°, or b<sub>10</sub> 202-3°, gives a well defined methiodide, m. 174°. The base is transformed by a mixt. of HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub> at 0° into the *nitro* compd. (III), golden yellow needles, m. 142°, reduced by SnCl<sub>2</sub> to 7-amino-*g*-ethylhexahydrocarbazole, an almost colorless, very viscous liquid, b<sub>10</sub> 224-5°, which shows all the color reactions characteristic of the simpler *m*-diamines of the aromatic series. It has not been found possible to effect the smooth dehydrogenation of 9-methyl- or 9-ethylhexahydrocarbazole; if the substances are passed over PbO and pumice the alkyl residues are lost and carbazole is produced.

J. C. S.

Behavior of certain dibenzamidoethylene derivatives prepared from iminazoles towards acid anhydrides. A. WINDAUS AND W. LAGENBECK. *Ber.* 55B, 3706-9 (1922); cf. C. A. 16, 1427.—BzNHCMe:CHNHBz and Ac<sub>2</sub>O at 180° yield 2,4(2,5)-dimethyl-

imidazole, identified as the picrate, m. 142°. The action of  $(\text{EtCO})_2\text{O}$  gives *4(5)-methyl-2-ethylglyoxaline*, hygroscopic, m. 45°; *oxalate*, m. 148°; *picrate*, yellow, m. 131°; *HCl salt*, hygroscopic, m. 132°; *nitrate*, m. 129°. 4(5)-Ethylglyoxaline is converted by  $\text{BzCl}$  and  $\text{NaOH}$  into  $\alpha,\beta$ - *dibenzamido- $\Delta\alpha$ -butylene*,  $\text{BzNHCH:CEtNHBz}$ , m. 146°, which  $\text{Ac}_2\text{O}$  transforms into 2-methyl-4(5)-ethylglyoxaline; *picrate*, yellow, m. 90-1°; *oxalate*, m. 141°. The glyoxaline obtained by Windaus and Ullrich (C. A. 9, 623) by the action of  $\text{NH}_3$  on rhamnose is identified as 4(5)-methyl-5(4)-ethylglyoxaline by comparison with an authentic sample. C. J. WESR

**Reduction of  $\gamma,\gamma'$ -dipyridyl.** OTTO DIMROTH and FRITZ FRISTER. *Ber.* 55B, 3963-7 (1922).—4,4'-Dipyridyl (I) is obtained in 90-5% yield by the action of O on a suspension of 1,1'-diacetyltetrahydro-4,4'-dipyridyl in glacial  $\text{AcOH}$  and subsequent addn. of  $\text{NaOH}$  to the soln. Reduction of I in  $\text{CaCl}_2$  soln. by  $\text{CrCl}_3$  (1 equiv.) leads to a dark green dyestuff composed of mol. proportions of I and 1,1'-dihydro-4,4'-dipyridyl, isolated as the di-HCl salt, for which the name *dipyridyl-violet chloride*  $\text{C}_{10}\text{H}_{10}\text{N}_4\text{Cl}_2$  is proposed. It is very sensitive to the air, being completely decompd. in 2 min. The dye differs from other semiquinonoid substances in that the reduced half is quinonoid and the oxidized half has the aromatic constitution. C. J. WESR

**Quiteninone.** SIGMUND FRÄNKEL, CHARLOTTE TRITT-ZIERING and LILY GOTTESMANN-GRAUER. *Ber.* 55B, 3931-5 (1922).—Oxidation of quinine with 30%  $\text{H}_2\text{O}_2$ , with  $\text{CuSO}_4$  as a catalyst, for 5 days at room temp., gave *quiteninone*, m. 156°, also obtained from quitenine, which indicates that the latter is an intermediate oxidation product of quinine (cf. Nierenstein, C. A. 15, 372). *Picrate*, m. 140°. *Me ester picrate*, decomp. 270°. If the esterification product is extd. with  $\text{Et}_2\text{O}$  and  $\text{HCl}$  passed into this ext. the *di-HCl salt*, m. 181°, ppts. The *oxime picrate*, m. 126°, results when the ketone and  $\text{NH}_4\text{OH.HCl}$  are treated with  $\text{NaOH}$  and the resulting sirup is treated with picric acid. C. J. WESR

**Absorption spectra of sulfuric and nitric acid solutions of phenanthroxazine and phenanthrazine.** B. FORESTI and R. MARTORELLI. *Gazz. chim. Ital.* 53, 262-4 (1923).—F. has recently (C. A. 16, 2684) shown that the di[9,10-monohydroxyphenanthryl]amine of Schmidt and Lupp (C. A. 4, 1742) is a mixt. of 80-90% phenanthroxazine (I) and the rest phenanthrazine (II). This mixt., as well as its components, gives in concd.  $\text{H}_2\text{SO}_4$  blue solns. which acquire a violet-red and yellow tint on adding a nitrate. F. and M. have detd. the spectrographs for I and II and the mixt. in the visible part of the spectrum, in both of these solns. The results, which are described in detail, show that the spectrograph for the mixt. in both cases is the combination of the spectrographs for I and II in these solvents. F. J. WITZEMANN

**Isomerism of reduced derivatives of quinoxaline. I. The four stereoisomeric 2,3-diphenyl-1,2,3,4-tetrahydroquinoxalines.** G. M. BENNETT and C. S. GIBSON. *J. Chem. Soc.* 123, 1570-5 (1923).—The reduction of 2,3-diphenylquinoxaline was shown by Hinsberg and König (*Ber.* 27, 2181) to yield 2 isomeric 1,2,3,4-tetrahydro bases. On account of the presence of 2 similar asym. C atoms in the mol.,  $\text{C}_{16}\text{H}_{14}\text{N}_2\text{CHPh.CHPh.NH}$ , 2 optically active and 2 inactive isomers

should be capable of existence. These have been prepd. The " $\beta$ -base" of H. and K. is *meso-2,3-diphenyl-1,2,3,4-tetrahydroquinoxaline*, yellow, m. 142-3°; crystal system: monoclinic, class  $\bar{b}$ , holosymmetric; habit: tabular parallel to A (100); axial angle,  $119^\circ 7'$ ;  $a:b:c = 2.367:1:2.038$ ;  $A(100)$ ,  $C(001)$ ,  $p(110)$ ,  $r(101)$ . The large face showed an extinction parallel to the  $b$  axis. *d-Camphor- $\beta$ -sulfonate*, decomposes between 206 and 13°,  $[\alpha]_{\text{D}}^{20} 24.4^\circ$ ; the base isolated from the salt was inactive. The *dl*-compd. (" $\alpha$ -base" of H. and K.) was resolved by means of this acid. *l-2,3-Diphenyltetrahydroquinoxaline d-camphor- $\beta$ -sulfonate*, m. 245-52°,  $[\alpha]_{\text{D}}^{20} 56.9^\circ$  ( $\text{EtOH}$ ,  $c$  0.441). *l-2,3-Diphenyl-1,2,3,4-tetrahydroquinoxaline*, m. 135-5.5°,  $[\alpha]_{\text{D}}^{20} -54.6^\circ$ ,  $[\alpha]_{\text{D}}^{20} -44.4^\circ$ ,  $[\alpha]_{\text{D}}^{20} -40.8^\circ$  ( $\text{EtOH}$ ,  $c$  0.799). *d-2,3-Deriv.*, m. 135-5.5°,  $[\alpha]_{\text{D}}^{20} 54.4^\circ$ ,  $[\alpha]_{\text{D}}^{20} 43.8^\circ$ ,  $[\alpha]_{\text{D}}^{20} 42.3^\circ$  ( $\text{EtOH}$ ,  $c$  0.416). These derivs. cryst. in enantiomorphous forms. Crystal system: Monoclinic, class 4, sphenoidal; axial angle,  $99^\circ 31'$ ;  $a:b:c = 0.6326:1:1.050$ ;  $C(001)$ ,  $B(010)$ ,  $p(110)$ ,  $p'(110)$ ,  $q(011)$ ,  $m(112)$ ,  $r(120)$ ,  $s(023)$ . *Di-Ac deriv.*, m. 190-1°. The *l*-form had  $[\alpha]_{\text{D}}^{20} 44.4^\circ$  ( $\text{EtOH}$ ,  $c$  0.423; the *d*-form,  $[\alpha]_{\text{D}}^{20} -44.7^\circ$  ( $\text{EtOH}$ ,  $c$  0.341). The m. p. of a series of mixts. of the *dl*-base with the *d*-base showed an eutectic at about 100° corresponding to 15-20% of the *d*-base. C. J. WESR

**Relation between cholesterol and the bile acids.** A. WINDAUS. *Z. angew. Chem.* 36, 309-10 (1923).—By means of structural formulas the changes from cholesterol, on the one hand, and the bile acids, on the other, to cholic acid are outlined. The

bile acid of swine (so-called  $\alpha$ -hyocholic acid) has the formula  $C_{26}H_{48}O_6$ , is isomeric with desoxycholic acid and is termed *hyodesoxycholic acid*. Upon reduction it yields hyocholic acid, the decompn. product of cholestane. It is probable that this new acid is more closely related to cholesterol than its isomer. C. J. WARR

The ultra-violet absorption spectra of the alkaloids of the isoquinoline group (STEINER) 3. Explosives (U. S. pat. 1,457,709) 24.

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Salicylates. M. E. PUTNAM and J. MCCREADIE. U. S. 1,459,900, June 26. In making Na salicylate, a soln. of salicylic acid is neutralized with  $Na_2CO_3$  or  $NaHCO_3$  and a small amt. of Sn salicylate or  $SnCl_2$  is added;  $H_2S$  is passed through the soln., the resulting ppt. is sepd. and the purified soln. is evapd. to dryness.

Ethers. C. B. CARTER and A. E. COXE. U. S. 1,459,177, June 19. Halogenated hydrocarbon derivs. of the aliphatic series such as  $MeCl$ ,  $EtCl$ ,  $CH_3Cl$  or isobutyl chloride (or the corresponding Br or I derivs.) are heated under pressure with an alc., e. g.,  $MeOH$ ,  $EtOH$ , normal propyl alc. or isobutyl alc., and an alk. compd. such as  $NaOH$ ,  $KOH$ ,  $Na_2CO_3$ ,  $NaHCO_3$ ,  $K_2CO_3$  or  $KHCO_3$ , to produce normal or mixed ethers. The formation of  $MeOEt$  from  $MeCl$ ,  $EtOH$  and  $NaOH$  takes place rapidly at  $100^\circ$  with deposition of  $NaCl$ .  $Et_2O$  is prepd. from  $EtCl$ ,  $EtOH$  and an alk. compd.

Chlorinating methane. R. LEISER and F. ZIFFER. U. S. 1,459,777, June 20. In making  $MeCl$  a mixt. contg. 1 vol.  $Cl$  to 6 vols.  $CH_4$  and also contg.  $HCl$  gas is exposed to actinic light. The mixt. is heated to start the reaction. With this proportion of gases  $MeCl$  is the main product.

Ethylene from ethane. P. E. HAYNES and G. O. CURME, JR. U. S. 1,460,545, July 3.  $C_2H_6$  is isolated in a state of substantial purity from natural gas or other gas rich in  $C_2H_6$  and is then treated for production of  $C_2H_4$ , e. g., by heating to above  $500^\circ$ .

Ethyl acetate. M. MUGDAN and W. HERRMANN. U. S. 1,459,852, June 26.  $AcH$  is brought in contact with Al alcoholate and  $AlCl_3$ .

Formaldehyde from carbon dioxide and hydrogen. A. HEINEMANN. U. S. 1,460,244, June 26. See Brit. 179,951 (C. A. 16, 3315).

1-Phenylimino-2-naphthoquinone. SOC. ANON. DES MATIÈRES COLORANTES ET PRODUITS, CHIMIQUES DE ST. DENIS, A. WAHL AND R. LANTZ. Brit. 191,064, Dec. 28, 1922. Addn. to 182,084 (C. A. 16, 4215). 2-Hydroxy-1-phenylnaphthylamine, the prepn. of which is described in the principal patent, is oxidized in alk. soln. E. g., a concd. soln. of  $NaOCl$ , contg. the theoretical quantity of  $Cl$ , is added, with vigorous stirring, to a cold dil. soln. of the hydroxyphenylnaphthylamine in  $NaOH$  and alc., the temp. being maintained at about  $5^\circ$ . The green cryst. ppt., which seps., is pressed and may be purified by recrystn. from dil. acetone or a mixt. of ether and petroleum ether. The product is sol. in org. solvents, forming a blue soln. and in  $H_2SO_4$  the soln. being reddish brown.

Indole- $\alpha$ -ethylamine hydrochloride from rutecarpine. YASUHIKO ASAHINA AND THE DAICHI SEIYAKU KABUSHIKI KAISHA. Japan. 41,593, Jan. 30, 1922. Boil 5 g. of rutecarpine with 40 cc.  $AmOH$  and 40 g. powdered  $KOH$ . Cool, mix with 50 cc. of  $H_2O$  and sep. the  $AmOH$  layer from the aq. layer. From the  $AmOH$  layer the K salt of anthranilic acid is deposited. Sep. the crystals, distil off the larger part of the solvent,

nearly neutralize the residue with dil.  $H_3PO_4$ , and boil the white silky crystals (about 3.1 g.) thus obtained with 5% HCl for 2-3 hrs. Make alk., ext. with  $Et_2O$ , dry and pass HCl gas into the ethereal soln.; colorless scales of indole- $\alpha$ -ethylamine hydrochloride, m. 245-6°, are deposited.

**Metalddehyde.** ELEKTRIZITÄTWERK LONZA. Brit. 190,891, Dec. 8, 1921. The stability under heat of metalddehyde prep'd. by the polymerization of AcH with acid or neutral catalysts is improved by treatment with  $NH_3$ . Any desired degree of stability can be obtained by passing air contg. definite proportions of  $NH_3$  over the metalddehyde and regulating the temp. and period of contact. Cf. C. A. 16, 2335.

**Barbituric acid compounds.** H. SEFTON-JONES (WULFING, J. A. (firm of)). Brit. 190,286, Oct. 8, 1921. The water-sol. Ca and Mg salts of C,C-diethyl- and C,C-phenyl-ethylbarbituric acids are obtained by digesting a hot sat'd. soln. of the acid with the theoretical quantity of freshly pptd.  $MgCO_3$ , which has not yet assumed the cryst. state, or of Ca or Mg hydroxide, filtering the soln. obtained and concg. and drying *in vacuo* at as low a temp. as possible. An example shows the treatment with freshly pptd.  $Mg(OH)_2$ . It is stated that the salts thus obtained are easily absorbable and give permanent mixts. with the earth-alkali salts of acetylsalicylic acid.

**Aminosulfonic acids.** G. POMA and G. PELLEGRINI. Brit. 190,114, Sept. 19, 1922. 1,8-Aminonaphthol-3,6-disulfonic acid H-acid is obtained by the following series of reactions. Naphthalene is sulfonated with oleum, the product nitrated, and the resulting nitronaphthalenetrisulfonic acid pptd. as Na salt by pouring into  $H_2O$  and salting out; the nitro comp'd. is then neutralized, first by soda and finally by  $CaCO_3$ , and reduced in aq. soln. by means of H under pressure in the presence of a catalyst. The catalysts mentioned are reduced metals (Ni, Co, Cu, Fe) or their salts (nitrates, silicates, fluosilicates) or their oxides "before or after reduction"; they may be used upon inert supports such as charcoal, pumice, quartz, metal oxides, kieselguhr, silicates, fluosilicates, etc., in place of H may be used water gas, "poor gas,"  $SO_2$  or "any other reducing gaseous mixt. whatever." The aminonaphtholtrisulfonic acid soln., is then saponified by heating with NaOH at 150-80° and the H-acid pptd. by mineral acid or the acid liquor from the nitration process. The process is stated to be applicable to production of other aminosulfonic acids, such as Cleve's acids, Freund's acid, S-acid, and metanilic acid, but the products to be reduced must not contain any halogen, S, Se, or Te in org. combination. The specification refers also to a filter in combination with an air pump and a vessel contg. lime for fixing the acid exhalations.

**Purifying lactic acid.** T. HAMBURGER. U. S. 1,459,395, June 19. Impure lactic acid or sol. lactates, either as produced by fermentation or at a later stage, are treated with a Mg comp'd. to form Mg lactate. The latter is sepd., decomposed with an acid such as  $H_2SO_4$ , and the liberated lactic acid is recovered by dissolving in acetone, ether or other solvent (which may be added to the Mg lactate before its decompn.). Crystd. Mg lactate may be washed with a soln. of  $MgSO_4$  or  $MgCl_2$  to effect its preliminary purification before treatment with  $H_2SO_4$  to liberate lactic acid.

**Organo arsenic compounds.** ÉTABLISSEMENTS POULENC FRÈRES. Brit. 191,029, Dec. 21, 1922. Aliphatic As compds. of the formula  $(AsCH_3)_x$  are prep'd. by heating acetyl arsenite to the point of decompn. By oxidation of the product, As compds. of the formula  $(AsCH_3O)_x$  are produced. According to the example, arsenious acid is heated with  $Ac_2O$  and a little  $AcONa$ ; when dissolved, the soln. is gradually raised to 180° until  $CO_2$  and  $HOAc$  cease to be evolved; the product is dried *in vacuo*, powdered, and extd. with soda or HCl. Oxidation is effected by adding  $H_2O_2$  to a suspension of the product in  $Na_2CO_3$ ; on filtering and acidifying with HCl, a white powder of the oxidized comp'd. is pptd.

**Organic arsenic compounds.** ÉTABLISSEMENTS POULENC FRÈRES. Brit. 191,028, Dec. 21, 1922. Hydroxy aliphatic arsonic acids are prep'd. by the interaction of an alkali arsenite with an aliphatic hydrocarbon contg. 1 or more halogen atoms and 1 or more hydroxyl groups, with subsequent acidification.  $HOCH_2CH_2AsO_2H_2$  is obtained by heating glycol chlorohydrin with  $Na_2AsO_3$  soln., and acidifying;  $C_2H_5(OH)_2AsO_2H_2$  and  $C_2H_4(OH)(AsO_2H)_2$  are produced either by treating glycerol mono- or di-chlorohydrin or epichlorohydrin with  $Na_2AsO_3$  followed by acidification.

**Ketones from secondary alcohols.** R. R. WILLIAMS and D. H. WHITE. U. S. 1,460,876, July 8. The vapor of secondary alcs., e. g., isopropyl alc. contg.  $H_2O$ , is passed in contact with brass heated to 500-800°.

## 11—BIOLOGICAL CHEMISTRY

PAUL H. HOWE

A—GENERAL

FRANK P. UNDERHILL

**Physical chemistry of the globulins. I. The alkali and alkaline earth globulins.** MONA ADOLF. *Kolloidchem. Beihefte* 17, 1-50(1923).—The purification of globulins (by electrodialysis) from human exudates and from horse serum is described. The material was dried over  $H_2SO_4$  *in vacuo*, extd. with  $Et_2O$ , and the purity established by the following detns.: there was no increase in cond. after the material was suspended in distd.  $H_2O$  ( $K = 3 \times 10^{-6}$ ); ash was 0.215%; P content, 0.047%. The dry globulin was dissolved in solns. of NaOH, KOH,  $NH_4OH$ ,  $Ca(OH)_2$ , and  $Ba(OH)_2$ . By soly. measurements and by gravimetric detn. of the amt. of metal ion entering into combination to form a neutral globulate, it was found that the metals combined in equiv. and not in mol. proportions. In contrast with casein, but one type of neutral salt is formed, only slightly hydrolyzed. In excess alkali it shows a base-combining capacity of about  $15 \times 10^{-3}$  g.-equivs. for one g. of the protein, and under these conditions is 24% hydrolyzed. Weak bases combine in much smaller amts. The viscosity of the solns., with increasing amts. of either strong or weak bases, shows considerable increase. The alkali concn. for max. viscosity and max. base combined do not coincide. By electro-metric measurements of H-ion concn. and by viscosity measurements, it is shown that the combination with base is a time reaction, requiring some 24 hrs. to reach equil.  $\Delta\epsilon$  for the neutral globulate was calcd. by extrapolation, and the mobility of the globulin ion detd. to be 50 mhos. By the use of the Walden-Ostwald rule the valence of negative globulin was found to be 4. Values for ion mobility and valence of the globulin are of importance for the prepn. of pure globulins, and very probably have some connection with the phenomena of immunity. Cond. of the alkaline earth-globulin salt, when compared on the basis of the gravimetric metal ion detns., showed the same behavior as analogous alkali salts. From the results of neutralization expts. (1 millimol. alkali:3 g. globulin), an equiv. wt. of 3000 is derived, or mol. wt. = 12,000.

H. W. BANKS, 3RD.

**Melanine from pyrrole derivatives.** PIETRO SACCARDI. *Biochem. Z.* 132, 443-56(1922).—Injection of pyrrole derivs. gives rise to the formation of melanogen and melanine without distinction, the more readily the simpler and more stable the pyrrole-nucleus. The organism later attempts to transform them into desired compds. The Thormählen reaction (violet color with Na nitroprusside and NaOH, changed to blue by AcOH) is not always evidence of pyrrole compds. and melanuria. The melanogens in the urine in rabbits, which have been injected with pyrrole derivs., cannot be extd. with  $Et_2O$  and show the same reactions as the melanogens of the urine of a melanosisarcoma patient. The organism converts melanogens and pyrrole derivs. into melanine only in certain cells. Pyrrole derivs. circulating in the blood are rendered capable of elimination, and melanine is rendered sol. by conversion into melanogen. After the injection of pyrrole derivs. into a given region, melanine is found first in the bulb, then also in the medullary substance and stem of the hairs; the hair grows black so long as pyrrole derivs. circulate in the blood; thereafter it grows in its natural color. If the skin of the injected region be free from hair and exposed to the light, it darkens to a certain extent. The pyrrole derivs. usually do not behave like compds. foreign to the animal organism. On passing from pyrrole to its more complex and less readily oxidized derivs., excretion as melanogen becomes more difficult. With the exception of pyrrole itself, repeated injections of its derivs. at a given spot give rise to local thrombosis, nephritis and degeneration of the connective tissue. Melanine and melanogen are probably merely very simple cyclic complexes of the pyrrole nucleus. Ehrlich's diazo reaction is positive with pyrrole and negative with its derivs. It and its derivs., injected subcutaneously, give rise to a marked diazo reaction, and, with the exception of pyrrolidone, to a marked reaction on oxidation with  $FeCl_3$  and HCl.

JOSEPH S. HEPBURN

**Animal luminescence.** E. N. HARVEY. *J. Franklin Inst.* 196, 31-44(1923); cf. *C. A.* 16, 1465.—A lecture describing luminescence in general, and that of living matter in particular. Special attention is paid to the reactions between (1) luciferin, luciferase, and  $O_2$ , and (2) oxyluciferin and nascent  $H$ .

JOSEPH S. HEPBURN

**Oxygen-dissociation curve of blood and its thermodynamical basis.** W. E. L. BROWN and H. V. HILL. *Proc. Roy. Soc. London* 94B, 297-334(1923).—The heat of reaction of 1 g. mol. of hemoglobin with  $n$  mols. of  $O_2$  at const. vol. is 19000 cal. in the

presence of  $\text{CO}_2$ , 30500 cal. in the complete absence of  $\text{CO}_2$ , 30000 cal. in  $\text{CO}_2$ -free boric acid blood, the mean temp. being approx.  $34^\circ$ . When 1 g. mol. of  $\text{O}_2$  combines at const. pressure with hemoglobin in blood, 15000 cal. are evolved in the absence of  $\text{CO}_2$  at approx.  $34^\circ$ , 11500 cal. in boric acid blood at approx.  $34^\circ$  and 14100 cal. in boric acid blood at  $11^\circ$ ; if the reaction occurs at const. vol., the values are 14400, 10900, and 13500 cal., resp. At const. vol., approx. 11500 cal. are evolved in the reversible absorption of 1 g. mol. of  $\text{CO}_2$  by blood. The heat of reaction of  $\text{CO}$  with reduced blood is almost 50% greater than that of  $\text{O}_2$ ; therefore  $\text{O}_2$  tends to displace  $\text{CO}$  at a higher temp. Boric acid is an excellent preservative for blood; 1%  $\text{B(OH)}_3$  preserves whole blood at room temp. even for weeks, and interferes little with the properties of the blood beyond causing loss of  $\text{CO}_2$  on boiling the blood in a vacuum. The sp. heat of oxygenated blood is approx. 0.1% greater than that of reduced blood. At  $37^\circ$ , the acid dissoc. const. of unsatd. hemoglobin is approx.  $7.5 \times 10^{-9}$ , that of satd. hemoglobin approx.  $5 \times 10^{-7}$ . The hemoglobin ion has approx. 67 times the affinity for  $\text{O}_2$  or  $\text{CO}$  which is possessed by the hemoglobin mol. The acid dissoc. const. of oxy- or  $\text{CO}$ -hemoglobin is almost as large as that of  $\text{H}_2\text{CO}_3$ ; this explains the liberation of  $\text{CO}_2$  on oxygenation of blood. The acid dissoc. const. increases with a rise in temp. The combination of  $\text{O}_2$  or  $\text{CO}$  with hemoglobin in blood is a reversible chem. reaction governed by a simple equation derived from the laws of mass action. A set of dissoc. curves is given for normal human blood for temps. ranging between  $0^\circ$  and  $43^\circ$ . JOSEPH S. HEPBURN

**Velocity with which carbon monoxide displaces oxygen from combination with hemoglobin.** L. H. HARTIDGE AND F. J. W. ROUGHTON. *Proc. Roy. Soc. London* 94B, 336-67(1922); cf. *C. A.* 17, 1971.—*First method.*—A soln. contg. O-hemoglobin and  $\text{CO}$ -hemoglobin was made to pass through 2 glass tubes arranged in series. The first tube was exposed to a powerful light, which altered the position of equil.; the second tube was kept in the dark so that the equil. gradually returned to its original position. The actual % satn. with  $\text{CO}$  at different parts of the dark tube was detd. by means of a reversion spectroscop. and the equil. const.  $k_2$  calcd. *Second method.*—The soln. was subjected to the action of a powerful beam of light, which was suddenly obstructed. By means of an electrically controlled stopwatch, detn. was made of the time required for the equil. to return from the unstable to the stable; the change in equil. was followed by means of the reversion spectroscop. *Results.*—The equil. const.  $k_2$  at  $16^\circ$  (lab. temp.) was found to be 0.51 and 0.59 by the first method and 0.44 and 0.40 by the second method, the true value is therefore  $0.5 \pm 0.1$ ; the value at  $1^\circ$  (second method) was 0.1, and at  $34^\circ$  (first method) 2.6. The temp. coeff. per  $10^\circ$  had a mean value of 2.5. When the values of  $\log k_2$  at different temps. were plotted against the reciprocals of the temps., a straight-line relationship resulted. JOSEPH S. HEPBURN

**Existence of an unidentified sulfur grouping in the protein molecule.** I. Denaturation of proteins. L. J. HARRIS. *Proc. Soc. London* 94B, 426-41(1923).—An undiscovered S linkage apparently exists in certain proteins. The production of a group which reacts with Na nitroprusside is an essential feature of the denaturation of ovalbumin and certain other proteins. This group may be present in metaprotein, proteose, peptone, and polypeptide obtained by proteolysis. This nitroprusside reaction may be due to the presence in the native protein of a thiopeptide or similar grouping which gives rise to an active SH group by hydrolysis or by a keto-enol transformation. JOSEPH S. HEPBURN

**Mechanism of ciliary movement. III. Effect of temperature.** J. GRAY. *Proc. Roy. Soc. London* 95B, 6-15(1923); cf. *C. A.* 16, 3344.—In well aerated tissue the consumption of  $\text{O}_2$  is directly proportional to the speed of the ciliary beat between  $0^\circ$  and  $30^\circ$ . At temps. above  $30^\circ$ , the initial consumption of  $\text{O}_2$  is not maintained, as a result of the disintegrative effect of the temp. on the epithelium. JOSEPH S. HEPBURN

**The results and aims of general enzyme chemistry.** H. VON EULER. *Ber.* 55B, 3583-3600(1922).—A lecture. J. C. S.

**The isolation of enzymes.** RICHARD WILLSTÄTTER. *Anales soc. espñ. fis. quim.* 20, 367-79(1922); *Ber.* 55B, 3601-23.—A general discussion of methods. No expl. data are given. L. E. GILSON

**Heteroalbumose.** E. ZUNZ AND P. GYÖRGY. *Bull. acad. roy. Belg.* 359-80 (1914).—An investigation of Pick's heteroalbumose (*Z. physiol. Chem.* 28, 219-87 (1899)) by two methods: (1) fractionation by Siegfried's method (*Ber.* 39, 397-401 (1906)) and (2) ultra-filtration, using collodion and  $\text{AcOH}$  of 3 different concns. The authors conclude that P.'s heteroalbumose is really a mixt. The chief constituent (insol. in twice its bulk of 95% alc.) is a heteroalbumose with  $[\alpha]_D^{20} = -72.5^\circ$ , but associated with it are several protoalbumoses of low rotatory power and sol. in twice their bulk of alc. One of these is apparently responsible for the Adamkiewicz reaction given by



some preps. of P.'s heteroalbumose. Altogether, 15 different fractions of the latter are examd. and compared with the original substance by means of elementary analysis, rotatory power, Au nos.  $n$ , etc. J. C. S.

Studies on enzymes. II. H. VON EULER AND K. MYRBACK. *Arkiv Kemi Mineral. Geol.* 8, No. 22, 31 pp. (1922); cf. C. A. 16, 2338.—Toluene greatly accelerated the self-fermentation of fresh and dried yeast (bottom brewer's yeast H), while EtOAc had the opposite effect. In the latter case, the increased  $p_H$  because of hydrolysis of the ester, was not the inhibiting agent. Addn. of heated dried yeast also accelerated the self-fermentation, while addn. of glucose,  $CHCl_3$  and NaCl inhibited it and lactose had no effect, unless the acidity was so adjusted as to permit activity of lactase. EtOH was formed in self fermentation, but the polysaccharide of yeast was not decomposed in the reaction. The invertase of bottom yeast H was partially destroyed by desiccation. After 3 and 4 days autolysis, resp., the autolyzates contained 62.4 and 73.5% of the original invertase. This autolyzate was unchanged after several months under toluene and could be concd. under 10 mm. pressure at 25–30° without loss. Kaolin completely adsorbed the enzyme, while infusorial earth was without effect. Absorption by  $Al(OH)_3$  took place best in neutral or acid soln., but was only slightly checked in alk. soln. Recovery of the absorbed enzyme by extn. with  $H_2O$  was unsuccessful, while a mixt. of 20% cane sugar and 1%  $KH_2PO_4$  solns. extd. 60–80% from the  $Al(OH)_3$  ppt. Pptn. with 96% EtOH removed all the active enzyme from the autolyzate, but only 19% of the original enzyme could be extd. from the EtOH ppt. with 20% EtOH. The inactivating action of  $p$ -phenylenediamine on invertase, which is greater than that of  $p$ -toluidine, was inhibited by the presence of cane sugar. If the  $p$ -phenylenediamine was present as a salt, i. e., in a  $p_H$  of 2–3, its inactivating action was less than at a lower H-ion concn., where a greater concn. of free base was present.  $CH_2O$  also had a more powerful action as an inactivating agent at a  $p_H$  of 5.5 than at 3.8. This was probably due to the fact that the free amino group of the invertase mol., which reacts with the aldehyde, is more reactive in free form than when, in acid soln., the N is present in the form of salts of quinquivalent N. H. B. LEWIS

An oxidative mechanism in the living cell. F. G. HOPKINS. *Chemistry and Industry* 42, 676–8; *Lancel* 1923, I, 1251–4; cf. C. A. 16, 107.—A review in which the role of glutathione is described. E. R. LONG

Swelling of starch and coagulation of albumin by heat. (Temperature coefficients in heterogeneous media.) V. V. LEPESEKIN. *Kolloid Z.* 32, 42–4 (1923); cf. C. A. 17, 405.—Swelling of starch in hot water and coagulation of albumin by heat are different physically, but similar chemically. Temp. coeffs. of the changes show this. A. M.

Reversible and irreversible coagulation of albumin by salts. V. V. LEPESEKIN. *Kolloid Z.* 32, 44–6 (1923); cf. C. A. 17, 405.—Coagulation of albumin by salts is controlled by the mass-action law and the compd. formation between albumin and the alkali metals. Very large quantities of salt are generally required, causing dehydration of the emulsoid particles. If no complex is formed, then the ppt. is generally reversible; if irreversible then the formation of a complex must be assumed. The series  $CNS > I > Br > Cl$  is recognized but halogen acids and halogen salts prevent irreversible pptn. A. MUTSCHERLER

Types of casein coagulation. F. LÖBENSTEIN. *Kolloid Z.* 32, 264–72 (1923).—The digestibility of casein depends much on the form of the coagulum. Ca caseinate soln., consisting of 3.6 g. casein and 100 cc. lime water (titrated against 0.1 N HCl contg. 1.2–1.25% CaO) was employed for the investigation after 24 hrs. standing. Digestion with increasing HCl (0.05–0.9%) content and addn. of carbohydrates, salts, milk fat, albumin and enzymes showed the important role of HCl in digestion, which between 0.2 and 0.3% shows an optimum. With lower HCl content the casein is in a dehydrated form different from that at higher HCl concns. At lower HCl content the flocculation takes place rapidly; at higher concn. much more slowly. Both albumin and sugar favor dissolution still further. Milk salts decrease the dissolution; pepsin has no effect. A. MUTSCHERLER

The action of aluminium hydroxide on the most important proteins, enzymes and toxins. M. A. RAKUSIN. *Ber.* 56, 1385–8 (1923).— $Al(OH)_3$  acts only as a pure absorbent for casein. With other proteins it splits the mol. even at room temp. One pt.  $Al(OH)_3$  ten pt. soln. is the most efficient quantity to employ. A table is included giving quant. data on the amt. of protein, etc., absorbed by  $Al(OH)_3$ . Optical rotation data and literature are also tabulated.  $Al(OH)_3$  is particularly effective for the purification and quant. analysis of pepsin, chondrin and diphtheria antitoxin. All reactions take place at room temp. in the course of 24 hrs. It is essential to use anhyd.  $Al(OH)_3$ . On alc. ext. it acts very selectively. The cryst. carbohydrates are not attacked. GEORGE W. FUCHER

**Toxicity of autolyzates and tissue extracts.** AUGUSTE LUMIÈRE. *Compt. rend.* 176, 1415-7(1923).—A maceration of animal tissue 1 to 3 days old may be very toxic, while the same maceration after 8 days may be harmless. The reasons for these phenomena are discussed from the point of view of L.'s *La théorie colloïdale de la biologie et de la pathologie*, Chiron, Paris 1922.

**Composition of glycogen.** SAMEC AND V. ISAJEVIC. *Compt. rend.* 176, 1419-21 (1923).—N-free glycogen, prepd. from dog liver, in 2% soln. heated to 120° for 1 hr. appears to have a mol. wt. near 114000. By electro dialysis a soln. of glycogen can be decompd. into 2 parts; 80% remains in the form of sol and in 1% concn. has a cond. of  $1.4 \times 10^{-4}$ ; about 20% gives a flocculent pasty ppt., strongly hydrated. The cond. of this part in 1% soln. is  $4.1 \times 10^{-5}$ . Glycogen is analogous to starch but differs in yielding far less gel. A more important difference is the P content, which is 0.721% in glycogen to 0.175% in potato starch. With starch the gel contains all of the P. The gel of glycogen is less rich in P (0.135%). Although contg. 0.721% of P, the elec. cond. is slight, showing that P is probably in a non-ionized org. combination. The existence of P in glycogen indicates a reserve of P.

**Phase reversal in protoplasm and emulsions.** WILLIAM SEIFRIZ. *Science* 57, 694-6(1923); cf. Clowes, C. A. 10, 1753.—A review, also an announcement of a forthcoming paper.

**Electrical resistance of phenol-water systems and of protoplasm.** M. H. FISCHER. *Science* 57, 724-7(1923).—The system phenol-water in its 2 phases, water dissolved in phenol and phenol dissolved in water, presents an analogy by which protoplasm is comparable to a soln. of water in phenol, and the secretions of the body to the soln. of phenol in water. Purified phenol shows a resistance of over 210000 ohms when measured in the usual way by fixed platinized Pt electrodes, Wheatstone bridge and telephone. Addn. of water to such pure phenol progressively decreases the resistance until when satd. with water at 20° the resistance is not less than 21000 ohms. When equal vols. of liquefied phenol and water are mixed an increase in vol. takes place. The addn. of acid or alkali to the phenol-water system reduces the elec. resistance of the hydrated phenol phase. When enough of either acid or alkali is added the resistance approximates that of solns. of phenol in water. At the same time the addn. of acids decreases the vol. slightly but the addn. of alkalies progressively increases it. Or phenol "swells" more in alkali than in pure water. Different alkalies are unequally effective in reducing the resistance of hydrated phenol; KOH, NaOH and Ca(OH)<sub>2</sub> are progressively less effective in the order named. The addn. of any single neutral salt to a phenol-water system also lowers the elec. resistance of the phenol phase but not as much as do acids or alkalies. The nature of the salt and its concn. make a difference. In general the amt. of decrease of resistance is greatest with univalent radicals, less with bivalent and still less with trivalent. The addn. of EtOH to a phenol-water system at first lowers the elec. resistance of the hydrated phenol (though not as markedly as the addn. of an electrolyte) and then increases it to twice the figure for pure hydrated phenol. But the addn. of EtOH increases the vol. Only the lower monatomic acls. cause a decrease in the elec. resistance; the higher members cause an increase. These findings are applied in the explanation of certain aspects of cell behavior, more particularly the phenomena of "permeability," of "cell membrane" or of "protoplasm" in general. In spite of the conclusion that a physiol. salt soln. is supposed to be osmotically comparable with the salts dissolved in a living animal or its body fluids, the former will register only  $\frac{1}{4}$  to  $\frac{1}{10}$  the elec. resistance of the latter. This fact can be understood only by denying to the salts found in protoplasm any large existence in uncombined form, or by concluding that the cell is a different sort of solvent for these salts than is water. Exptl. evidence supports both of these conclusions. What has been said above for phenol-water systems is true of many other mutually sol. systems, such as quinineol, lower fatty acids, soaps and various proteins with water.

**Pigments in horse hair.** KARL TUTSCHKU. *Biochem. Z.* 135, 585-6(1923).—The alc-ether ext. of horse hair shows reactions for lipochrome. Cholesterol-like crystals are found on evapn. of this ext.

**Röntgen ray action and protoplasmic viscosity.** FRIEDL WEBER. *Arch. ges. Physiol.* (Pflüger's) 198, 644-7(1923).—No changes in the viscosity of the cytoplasm of *Spirogyra* or *Phaseolus multiflorus* could be detected following irradiation. G. H. S.

**Chloramine and its action on organic substances.** N. O. ENGFELDT. *Z. physiol. Chem.* 126, 1-28(1923); cf. C. A. 16, 3673.—Chloramine T is stable in soln. if kept in the dark. In the sunlight the soln. becomes acid on account of the formation of chlorinated sulfonic acids. It has no action upon fats or carbohydrates; amino acids are attacked, as are peptones and proteins to a less extent. Hippuric acid is unaffected.

The N of the NHCO group in proteins is much more resistant to chloramine than to NaOCl. NH<sub>2</sub> and aldehydes are also affected more slowly than by NaOCl.

R. L. STEHLE

Action of poisons on malt amylase and contributions to the phenomena of starch liquefaction. III. URBAN OLSSON. *Z. physiol. Chem.* 126, 29-99(1923); cf. *C. A.* 16, 264.—On poisoning malt amylase with CuSO<sub>4</sub> and I the liquefaction and saccharification processes decrease in parallel fashion. Aniline depresses the former but not the latter process. The liquefaction process conforms to the equation for a monomol. reaction and its velocity is proportional to the amt. of enzyme present.

R. L. STEHLE

Keratin. III. A. HEIDUSCHKA AND E. KOMM. *Z. physiol. Chem.* 126, 130-42 (1923); cf. *C. A.* 17, 2294.—The peptic digest of partially hydrolyzed keratin after the removal of the keratose yielded a peptone by pptn. with Fe alum, which on removal of the Fe and further purification appears to be a chemical entity;  $[\alpha]_D^{20}$  —15.45. Its Ba salt contains 19.7% Ba. IV. *Ibid* 261-76.—Keratose from horn was sepd. into heterokeratose, protokeratose and 5 deuterokeratoses. The behavior of each toward a variety of protein reagents is described.

R. L. STEHLE

Pancreatic enzymes. III. Pancreatic amylase. R. WILLSTÄTTER, E. WALDSCHMIDT-LEITZ AND A. R. F. HESS. *Z. physiol. Chem.* 126, 143-68(1923); cf. *C. A.* 17, 2718.—The glycerol ext. of pancreas was freed from lipase by adsorbing the latter with Al(OH)<sub>3</sub>. Trypsin was removed from the lipase-free soln. by adsorption with kaolin in AcOH soln. Further purification of the amylase by adsorption of the amylase in 50% alc. with Al(OH)<sub>3</sub> and elution of the enzyme with (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub> in NH<sub>4</sub>OH gave a prepn. 10 times as active as any heretofore described. It is free from protein but gives Molisch's reaction.

R. L. STEHLE

The existence of the triphosphonucleic acid of Thannhauser and Dorfmeüller. R. FEULGEN AND H. ROSSENBECK. *Z. physiol. Chem.* 127, 67-79(1923); cf. *C. A.* 10, 182.—The triphosphonucleic acid described by T. and D. is a myth. When the product described was analyzed for guanylic acid only 6% instead of the theoretical 33% could be found.

R. L. STEHLE

Inactivation of saccharase by halogens. H. v. EULER AND K. JOSEPHSON. *Z. physiol. Chem.* 127, 99-114(1923).—When saccharase solns. were incubated with small amts. of I for a min. their activities were reduced to about half their normal values. With longer incubation periods further depression took place very slowly and after 16 hrs. incubation no activity was exhibited. Br exerts its inhibitory action without any incubation period. One g.-atom of I is capable of reducing the activity of 20 kg. of saccharase of high potency (inversion power = 230) to half its ordinary value.

R. L. STEHLE

Sorption of saccharase by aluminium hydroxide. H. v. EULER AND K. MYRBÄCK. *Z. physiol. Chem.* 127, 115-24(1923).—Phosphates exert a specific inhibitory influence on the adsorption of saccharase with Al(OH)<sub>3</sub>. If Me<sub>2</sub>CO is added to the enzyme soln. to facilitate its adsorption with Al(OH)<sub>3</sub> the adsorbed enzyme is largely destroyed.

R. L. STEHLE

Composition of the proteins. II. N. TROENSEGAARD. *Z. physiol. Chem.* 127, 137-85(1923); cf. *C. A.* 15, 2884.—Gliadin was acetylated in glacial AcOH, reduced and then sepd. into a basic fraction and an acid fraction. The former consists of NH<sub>2</sub> and pyrrole derivs.; the acid portion consists of a small proportion of ether-sol. pyrrole acids and a large proportion of heterocyclic acids. Gelatin was treated similarly. The results are discussed on the basis of T.'s theory of protein structure, viz., that proteins are not built up on the polypeptide plan but are composed of hydroxy heterocyclic groups.

R. L. STEHLE

Chemistry of the proteins. III. Iodization of protein with nitrogen iodide. F. BLUM AND E. STRAUSS. *Z. physiol. Chem.* 127, 199-207(1923).—When 1.5-2.0% solns. of protein in 3-4% NH<sub>4</sub>OH were treated with I until the Millon reaction disappeared products were obtained which gave the biuret reaction and were digested with pepsin-HCl but which differed from previously obtained iodized proteins in their insoly. in NaHCO<sub>3</sub> soln. Derivs. of serum albumin, egg albumin and thyroglobulin were prepd. They contained about 5-7% I.

R. L. STEHLE

Enzymic fat synthesis. II. L. SPIRGEL. *Z. physiol. Chem.* 127, 208-9(1923).—The union of fatty acids and glycerol when catalyzed by lipase appears to proceed better in a water-poor medium.

R. L. STEHLE

Transformations of amino acids in the presence of sugar. S. KOSTYCHEV AND W. BRILLIANT. *Z. physiol. Chem.* 127, 224-33(1923).—When yeast autolyzates and monoses are incubated at 30-55° under sterile conditions substances form which are pptd. with Cu(OH)<sub>2</sub> and contain N. During the process of their formation the amino

N diminishes. The insol. material does not reduce Fehling soln. but by decompn. with  $H_2S$  carbohydrate is liberated, which then reduces. R. L. STEHLÉ

The specificity of enzymes. R. WILLSTÄTTER AND R. KUHN. III. The affinity of enzymes for stereoisomeric sugars. R. KUHN. *Z. physiol. Chem.* 127, 234-42 (1923); cf. *C. A.* 17, 2718.—The presence of freshly dissolved  $\beta$ -glucose lowers the rate of hydrolysis of sucrose by saccharase but  $\alpha$ -glucose has no effect. This is also true when raffinose is substituted for sucrose. Both glucoses inhibit the hydrolysis of maltose by maltase. The decompn. of salicin by emulsin is slowed by  $\beta$ -glucose but not by  $\alpha$ -glucose and the decompn. of helicin by  $\beta$ -glucose but not by  $\alpha$ -glucose. R. L. STEHLÉ

Further studies on the stepwise decomposition of proteins. E. ABDERHALDEN AND HIDEKI SUZUKI. *Z. physiol. Chem.* 127, 281-90 (1923).—Feathers were hydrolyzed with  $H_2SO_4$  and an attempt was made to isolate any complexes which might be present. A substance which may have been composed of 1 glycine and 3 proline molecules was studied but the results were inconclusive. R. L. STEHLÉ

Hematoidin. HANS FISCHER AND FRITZ REINDEL. *Z. physiol. Chem.* 127, 299-316 (1923).—The identity of hematoidin and bilirubin is probable because of the likeness of the crystal forms (crystallographic data are given) and the similarity in their behavior on coupling with benzenediazonium chloride. R. L. STEHLÉ

Bile pigments. VII. HANS FISCHER AND GEORG NIEMANN. *Z. physiol. Chem.* 127, 317-28 (1923).—Bilirubin in NaOH by reduction with H in the presence of colloidal Pd gave mesobilirubinogen (I) which pptd. on acidification. It was dissolved in  $CHCl_3$  and petroleum ether added, which caused, a slight pptn. The filtrate on evapn. gave a cryst. residue, which was recrystd. from EtOAc; m.  $200^\circ$ . I may also be obtained in similar fashion from mesobilirubin (II). If II is esterified in MeOH with HCl mesobilirubin dimethylester hydrochloride  $C_{42}H_{66}N_4O_6 \cdot 2HCl$ , m.  $190^\circ$  (not sharp) is formed. By oxidizing II with  $HNO_3$  (sp. gr. 1.375) a practically theoretical yield of methyl-ethylmaleinimide is obtained. R. L. STEHLÉ

Influence of the temperature upon the action of invertase and a theory of the mechanism of the action of invertase. BUNSUKE SUZUKI. *J. Chem. Soc. Japan* 44, 231-96 (1923).—At  $15^\circ$ ,  $25^\circ$  and  $37^\circ$ , with variable concns. of sucrose (3-25%), the velocity of the inversion was measured with a const. amt. of the enzyme with const.  $H$ -ion concn. ( $p_H = 4.3$ ). If the velocity const. is calcd. on the basis of monomolecular reaction, it gives ascending values as the inversion proceeds. In order to obtain true velocity of conversion at any moment, S. plotted a curve (% of inversion against time), and obtained a tangent at a desired point on the curve. According to the monomolecular formula, velocity per unit concn. should be const. Expt. showed, however, that the velocity (initial) for 3, 4, 5, 6, 8, 10, 12, 14, 18, 25% sugar at  $15^\circ$ ,  $25^\circ$ , and  $37^\circ$  was, resp. as follows: 0.029, 0.028, —, 0.028, 0.028, 0.028, 0.029, 0.027, —, —, 0.056, 0.053, 0.056, 0.054, 0.056, 0.056, 0.050, 0.046, 0, 0; 0.085, 0.096, 0.100, 0.097, 0.101, 0.099, 0, 0.093, 0.084, 0.081. If g. of sucrose inverted per min. per unit concn. is plotted against concn. of sucrose, a smooth descending curve is obtained, which shows that velocity is proportional to concn. of the sugar adsorbed by the enzyme. With a unit concn. of the enzyme, therefore, the smaller the concn. of the sugar, the more absorption with consequent increase in velocity. Further calcn. shows that at  $p_H = 4.3$ , at  $37^\circ$ , with 10% sucrose, the invertase does not lose its power for 10 hrs. and that at a const. condition, the velocity is the same as long as the ratio between sucrose and inverted sugar is the same. An equation for calcn. of velocity const. for "satd." condition (limited concns. of sugar at which the max. velocity is obtained at given condition) is given.  $S = X/(a - X) = K[X/(a - X)]^{(1/n)}$ , where S is not const. and becomes = K, when  $a = 2X$ . K for 3, 4, 5, 6, 8, 10% sugar at  $15^\circ$ ,  $25^\circ$ , and  $35^\circ$  is 0.5, 0.5, —, 0.4, 0.5, 0.5; —, 0.4, 0.5, 0.4, 0.4, 0.5; —, —, 0.5, 0.4, 0.5, and 0.5 and n, calcd. from mean velocity of "satd. condition," varies from 1.0 to 1.4 depending upon temp. and degree of inversion. The temp. coeff. is 1.9 between  $15^\circ$  and  $25^\circ C.$ , and 1.5 at  $25$ - $37^\circ$ . The method of prepn. of the invertase, and the exptl. conditions are described in detail. S. T.

Activity of several kinds of enzymes of rice in storage. Y. NOGUCHI. *J. Sci. Agr. Soc. (Japan)*, No. 245, 115-20 (1923).—Two kinds of Japanese rice (Aug. crop) were divided into 3 portions, one was sun-dried for 4 days, the second similarly for 10 days and the third served as a control. The samples were put in storage in the fall for  $1\frac{1}{2}$  years, and their enzyme contents were analyzed at one-month intervals from March on. The results are: the activity of diastase suddenly decreased from July of the following year, followed by no particular change. Lipase showed gradual decrease and after Aug. there was more or less sudden decrease. Catalase gradually decreased

without any sudden change at any time. The oxidase content was always the same. Peroxidase decreased suddenly in Aug, but later there was no change until April following. The results were the same for all the samples. S. T.

**Biochemisches Handlexikon.** Vol. 10. Edited by EMIL ARDERHALDEN. Berlin: Julius Springer. 943 pp.

HAHN, AMANDUS: **Grundriss der Biochemie für Studierende.** Stuttgart: F. Enke. 265 pp.

LAER, HENRI, VAN: **La Diastase du malt.** Ghent: Ad. Hoste. 334 pp.

**Enzymic composition.** J. TAKAMINE and J. TAKAMINE, JR. U. S. 1,460,736, July 3. Seed spores of *Eurotium oryzae* or a similar fungus are propagated on sterilized wheat bran or other suitable cereal nutrient medium or in still residue of alc. distn., oil cake, or residues from sugar, glucose and starch factories and after 30-60 hrs. enzymes are developed which are extd. with  $H_2O$ . The enzymic product is strongly diastatic, and is also proteolytic and possesses some milk-coagulating and fat-splitting properties. It is suitable for use in destarching cotton fabrics, degumming silk, in bread-making and for similar purposes. In dil. soln. the product is somewhat unstable but may be stabilized by being prepd. in concd. form by reprecipitation, by treatment with fuller's earth or by the addn. of  $PhOH$  or other suitable antiseptic.

## B—METHODS AND APPARATUS

STANLEY R. BENEDICT

**Detection of bile pigments in the feces and their clinical significance.** H. PAILLARD and R. GOIFON. *J. med. franc.* 11, 79-83; *Chem. Zentr.* 1922, IV, 868-9.—A survey of well known methods for detecting bile pigments. C. C. DAVIS

**The detection of bismuth in urine.** DOMENICO GANASSINI. *Boll. chim. farm.* 62, 193-5(1923); cf. *C. A.* 17, 571.—In case of doubt as to whether the yellow color obtained by Dezani's KI method may be due to oxidation of KI by traces of some oxidizing agent, instead of the presence of Bi, the reaction mixt. should be shaken with an equal vol. of  $CHCl_3$  or  $CS_2$ . If the org. solvent takes on an amethyst color leaving the supernatant liquid colorless, free I is present and Bi absent. If both layers are colored, I and Bi are both present. If all the color remains in the aq. layer I is absent and Bi present.

A. W. DOX

**Abnormal constituents of urine. Test for glucose.** G. INGHILLERI. *Boll. chim. farm.* 62, 225-7(1923).—The following modification of Fehling soln. is proposed: cryst.  $Na_2CO_3$ , 185 g., Na citrate 160 g., cryst.  $CuSO_4$ , 16 g.,  $H_2O$  to make 1000 cc. In testing for glucose, heat 2 cc. of urine with 6-8 cc. of the reagent to boiling in a test-tube. An orange yellow ppt. of  $Cu_2(OH)_2$  indicates the presence of glucose. The ppt. is more easily recognized by artificial light than is the red  $Cu_2O$  from Fehling soln. The reagent keeps indefinitely and does not deteriorate when exposed to light. [No mention is made of Benedict's reagent, *C. A.* 3, 2171. ABSTR.] A. W. DOX

**Observations on the determination of blood urea.** JEANETTE A. BEHRE. *J. Biol. Chem.* 56, 395-404(1923).—When the soy-bean urease method is applied to whole blood, the urea obtained is partially detd. by the amt. of meal or concn. of ext. employed. In beef blood the apparent urea content may be increased by 50% when a concd. soy-bean ext. is used, though either concd. or dil. ext. will recover added urea quant. Many human bloods also show a marked difference in urea content in relation to the concn. of the enzyme used. Filtrates from beef blood (obtained by heat coagulation or by the use of tungstic acid) show practically no variation in relation to the concn. of enzyme employed, but such filtrates from human blood show at least slight differences. The compd. responsible for the increase when large amts. of soy-bean are used is present chiefly, if not wholly, in the corpuscles. It does not diffuse through collodion. Incubation, heat coagulation or heating with dil. acid failed to increase the true urea content of whole blood. A jack-bean ext. contg. as much urease as the concd. soy-bean ext. does not produce this additional  $NH_3$  from blood, indicating the presence of 2 enzymes in the soy-bean ext. The true urea content of blood is best represented by the urea figure obtained from blood filtrates, which are the same or slightly lower than the figures obtained from whole blood with small amts. of enzyme. I. GREENWALD

**A note on the Kramer-Tisdall method for the determination of calcium in small amounts of serum.** F. F. TISDALL. *J. Biol. Chem.* 56, 439-41(1923).—The method of Kramer and Tisdall (*C. A.* 15, 3857) is modified by employing a centrifuge tube with an outside diam. of 6-7 mm. at the 0.1 cc. mark, so that the supernatant liquid can be removed by decantation and only 2 washings are needed. The contents of the tube

are mixed by tapping it so as to give it a circular motion. Contrary to the report of Clark (*C. A.* 15, 1736), pptn. of the Ca is complete within 90 min. I. GREENWALD

**A modification of the Folin-Wu method for making protein-free blood filtrates.** R. L. HADEN. *J. Biol. Chem.* 56, 469-71 (1923).—The method of Folin and Wu is modified by dilg. the blood with 8 vols. of  $N/12$   $H_2SO_4$  and then adding 1 vol. 10%  $Na_2WO_4$ . Identical values for non-protein N, uric acid, creatinine, amino-acid N, sugar and Cl were obtained by the original and the modified methods. The advantages claimed are (a) use of only 2 solns., (b) more rapid filtration and (c) recovery of 15% more filtrate. I. GREENWALD

**The separation of the hexone bases from certain hydrolyzates by electrolysis.** G. L. FOSTER AND C. L. A. SCHMIDT. *J. Biol. Chem.* 56, 545-53 (1923); *Proc. Soc. Exp. Biol. Med.* 19, 348-51.—“When the hydrolytic cleavage products of casein, gelatin, fibrin and red blood cells are placed in the center compartment of a 3-compartment cell and a direct current (110 volts, 1.5 amps.) is passed through the soln., the basic amino acids migrate to the cathode compartment. When the acidity of the protein hydrolyzate is maintained at  $p_H$  5.5, arginine, lysine and histidine are transported in almost the same proportion as they existed in the protein hydrolyzate, while at an acidity of  $p_H$  7.5 only arginine and lysine migrate to the cathode, while histidine remains in the center compartment.” I. GREENWALD

**Estimation of urea with soy-bean urease.** HELLMUTH DEIST. *Klin. Wochschr.* 2, 930-1 (1923).—Amard's const. was calcd. from the urea content of urine and blood as detd. by the urease method, by means of a number of urease preps. The American prepn., Arlko urease, was the only one that gave const. values. Values ranging from 0.0391 to 0.1075 were obtained with the different urease preps. MILTON HANKE

**Simplification of the Kjeldahl process, particularly for the estimation of residual nitrogen.** ARNOLD HAHN. *Deut. med. Wochschr.* 46, 428-9 (1920).—The serum (1 cc.) is treated with water (7 cc.) and phosphotungstic acid (2 cc.) and centrifuged for several minutes. Five cc. of the supernatant liquid is filtered and treated with  $K_2SO_4$ , a little Cu sulfate, and concd.  $H_2SO_4$  (1 cc.). The action is complete in about 5 minutes. (A device for the removal of  $SO_3$  fumes is described and sketched in the original.) The contents of the flask are cooled to about  $60^\circ$  and diluted with water (10 cc.); after complete cooling, 25 cc. of alc. is added. NaOH soln. (33%, 5 cc.) is introduced and the  $NH_3$  is distilled through an uncooled tube, the end of which is considerably constricted, into  $H_2SO_4$  (0.01 N, 10 cc.); excess of the latter is titrated with 0.01 N alkali hydroxide soln. Three drops of Na alizarin-sulfonate soln. (1%) and 6 drops of methylene-blue soln. (0.05 g. in 100 cc. of water) are used as indicator; the color change is from brownish green to violet. J. C. S.

**Important source of error in the examination of urine for albumin with sulfosalicylic acid.** GREYF LASCH AND JOSEF REITSCHTETTER. *Munch. med. Wochschr.* 67, 484-5 (1920).—Schall's assumption (*C. A.* 14, 2805) that sulfosalicylic acid forms a ppt. with  $CaCl_2$  which can be mistaken for a pptn. of albumin is untenable. J. C. S.

**Quantitative estimation of blood sugar with the aid of methylene blue.** W. EISENHARDT. *Munch. med. Wochschr.* 67, 1382-3 (1920).—The process depends on the observation of Williamson (*Brit. Med. J.* 1896) that decolorization occurs within a few minutes when 40 cc. of blood of a diabetic patient is heated with alk. methylene-blue soln. (1:6000) on the water bath, while about 3 times this amt. of normal blood is necessary to produce the same effect. An estimate of the amt. of reducing substances can be formed if diminishing quantities of blood or serum are heated with methylene blue in alk. soln. and the limits of the change of color are observed. J. C. S.

**Method for the micro-estimation of chlorine in blood.** PAUL IVERSEN AND M. J. SCHIERBECK. *Ugeskr. laeger.* 84, 454-6. —0.1 cc. of blood is added to 0.8 cc. of 0.1 N NaOH and 4 cc. of 0.45%  $ZnSO_4$  soln. After heating for 3 minutes the liquid is filtered and treated with 0.2 cc. of 29%  $HNO_3$  and 1 cc. of 0.01 N  $AgNO_3$  soln. When the ppt. has settled, the clear supernatant liquid is titrated with 0.005 N  $NH_4CNS$  in the presence of one drop of satd.  $Fe NH_4$  alum soln. J. C. S.

**Bang's method for the micro-estimation of chlorine.** PAUL IVERSEN. *Ugeskr. laeger* 84, 456-8.—Discordant results in the micro-estn. of Cl are attributed to variations in the amt. of EtOH used for the extrn. of blood and in the method of extrn. J. C. S.

**The interconvertibility of creatine and creatine. III. The estimation of creatinine and creatine in blood serum.** AMANDUS HAHN AND GEORG MEYER. *Z. Biol.* 76, 247-56 (1922); cf. *C. A.* 16, 1437.—In the estn. of creatine in blood serum, trichloroacetic acid is very suitable for pptg. the proteins. Fifty cc. of serum are diluted with 25 cc. of water, and 50 cc. of a freshly prepd. 10% soln. of trichloroacetic acid are added. The creatine in the filtrate is then estd. by conversion into creatinine by treatment at  $60-5^\circ$

with HCl, and estd. along with the preformed creatinine as previously described (*loc. cit.*). In the estn. of the preformed creatinine, colloidal  $\text{Fe}(\text{OH})_3$  may be conveniently used as a protein precipitant.

J. C. S.

**Moisture-absorbing efficiency of carbon dioxide absorbents for metabolism apparatus.** R. E. WILSON. *Boston Med. Surg. J.* 187, 133-5(1922).—Wilson soda is designed to have a max.  $\text{CO}_2$ -absorbing efficiency without caking and as such absorbs very little moisture from the air. A relative humidity is maintained throughout the whole metabolism app. of about 80% at all times. When the metabolism rate is calcd. from a correction table constructed by modifying Clarke's table to allow for 80% relative humidity the error is less than that made by using a caking absorbent and correcting on the customary assumption of 0% humidity. (Cf. Roth, *Bost. Med. Surg. J.* 186, 411-65(1922); *C. A.* 16, 2703.)

JULIAN H. LEWIS

**The effect of phenol in the estimation of reducing sugars by the picramic acid methods.** H. C. SWRANY. *J. Lab. Clin. Med.* 8, 572-8(1923).—Phenol interferes with the detn. of sugar by the Lewis and Benedict method and new Benedict methods, causing a 2-3-fold color increase when the phenol is present in 1-4000 concn. In the detn. of blood sugar the phenols present in normal blood cause a 10% error by the Lewis and Benedict method, but no appreciable error by the new Benedict method. Where picramic acid methods are applied to the detn. of sugar in urine without the elimination of phenols an error of 20-50% results. No picramic acid method can be applied in the detn. of sugar in solus. preserved by phenols and many related coal-tar products. The phenol possibly reacts with decompn. products of glucose to give a colored product or one reducing picric to picramic acid.

E. R. LONG

**A comparative study of various methods of hemoglobin determination.** E. G. SENTRY. *J. Lab. Clin. Med.* 8, 591-604(1923).—The standard Dare hemoglobinometer is practical for hemoglobin concns. of 20-65%; above 70% the results are very misleading. The percentages obtained by the Newcomer disk method are reliable. The Cohen and Smith acid hematin method is accurate and fairly practical; it should be used in the estn. of hemoglobin in suspected cases of anemia. The special Dare instrument is a decided improvement over the old Dare form. The Tallqvist hemoglobinometer is probably quite as accurate as the standard Dare instrument.

E. R. LONG

**The determination of uric acid in blood by the method of Folin and Wu.** R. S. HUBBARD AND L. L. FINNER. *J. Lab. Clin. Med.* 8, 605-9(1923).—Increases in the urea concn. of the blood are usually accompanied by increases in the uric acid retention. Generally where uric acid is increased while the urea remains normal some degree of renal impairment can be demonstrated by other tests. The figure regarded as the upper limit of normal was placed for the Folin and Wu method at the low value of 2.5 mg. per 100 cc. blood. In about half the cases where borderline figures are obtained some evidence of nephritis is found.  $(\text{KOO})_2$  used as an anticoagulant before the removal of protein caused an apparent increase in the amt. of uric acid in some samples. In some cases where the min. amt. of  $(\text{KOO})_2$  was used uric acid was apparently not all recovered.

E. R. LONG

**The estimation of albumin in urine.** A. J. QUICK. *J. Lab. Clin. Med.* 8, 615-8(1923).—Ten %  $\text{CCl}_3\text{COOH}$  is the most satisfactory pptg. reagent in the detn. of protein in urine. The height of the ppt. is almost directly proportional to the concn. of the albumin between 0.05 and 0.5%. The ppts. with Esbach's and Tsuchiya's reagents are much affected by temp., the Esbach method giving especially low results above 20°. Variations in sp. gr. influence the vol. of the ppt. decidedly in the Tsuchiya method, the reading being 30% higher at 1.010-1.013 than at 1.020-1.025. The  $\text{CCl}_3\text{COOH}$  ppt. is not so susceptible to these influences, and with its use in tubes comparable to those used in the Esbach method values approximating the gravimetric are obtained.

E. R. LONG

**A clinical test for liver function.** EMIL BOGEN. *J. Lab. Clin. Med.* 8, 619-21(1923).—A modification of the Abel and Rowntree test. Inject 5 mg. phenoltetrachlorophthalein per kg. body wt. Exactly 1 hr. later withdraw 5-10 cc. blood and allow to clot. Divide the serum in 2 tubes and alkalize one with 2 drops 10% NaOH to bring out the color of the dye. Exam. the tubes in a 2 X 2 in. block contg. 4 test-tube size holes. Place an empty tube back of the tube of alkalized serum, and insert tubes contg. known amts. of alkalized pure dye back of the nonalkalized serum, which thus serves as a color compensating control. The standards consist of percentage diins. of a 1:10000 soln. A reading of less than 3% indicates normal liver function; 4-8% indicates partial hepatic insufficiency, and 8% or over pronounced liver impairment.

E. R. LONG

**A simple apparatus for producing mechanical hemolysis and its practical use.** D. J. DE WAARD. *J. Physiol.* 57, 195-9(1923).—The principle involved is the same as that made use of in homogenizing machines, viz. blood under a high pressure is forced through a very narrow slot. Two forms of the app. are described (1) with chamber of about 5 cc. capacity and (2) with a small pressing tube for which a few drops of blood will be sufficient. The smaller app. is useful in the detn. of the hemoglobin content of blood by the refractometric method of Howard (*C. A.* 14, 1684).

**Determination of ammonia in blood.** MOTOYUKI HARA. *J. Biochem. (Japan)* 2, 473-8(1923).—The methods of Folin, Folin-Denis, and of Iversen were compared. With pure solns. correct values for  $\text{NH}_3$  are obtained by all 3 procedures, but with blood the former 2 methods were found to give markedly high figures. This error is shown to be due to a splitting off of  $\text{NH}_3$  from protein, and can be avoided by keeping blood for several hrs. after the addition of alc. in large quantity. When this is done the results by all 3 methods coincide exactly.

**Diagnostic value of the determination of chlorine in the blood of the drowned.** KUMAO YAMAKAMI. *Tohoku J. Exptl. Med.* 4, 88-97(1923); cf. Gettler, *C. A.* 16, 267.—The cadaveric signs of death by drowning are described. Expts. were made by drowning rabbits in fresh and in salt water and detg. the concn. of NaCl in the blood of the left and right hearts, resp., after slow and after quick submersion. The av. excess of NaCl in the blood of the right heart in mg. per 100 cc. after quick submersion in fresh water was 87.5, after slow submersion 102. After quick submersion in the equiv. of sea water 141, and after slow submersion 187. In rabbits asphyxiated by strangulation the difference in the NaCl content of the right and left hearts averaged 2 mg. per 100 cc. greater in the right heart. The detn. of NaCl in the blood of the right and left hearts is of almost absolute diagnostic value in the recently drowned subject.

**Millon's reagent applied to the quantitative analysis of deproteinized serum.** I. GEORG HAAS. *Z. physiol. Chem.* 127, 39-51(1923).—Serum was deproteinized by adding an equal vol. of satd.  $\text{Na}_2\text{SO}_4$  soln., acidifying with AcOH and heating 0.5 hr. on a  $\text{H}_2\text{O}$  bath. To a portion of the filtrate enough  $\text{H}_2\text{SO}_4$  was added to make a 2.0% soln; this was heated at  $105^\circ$  for 50 min. and 5 cc. were then extd. with  $\text{Et}_2\text{O}$ . After freeing the extd. soln. from  $\text{Et}_2\text{O}$  1 cc. was dild. with 3 cc. of  $\text{H}_2\text{O}$  and 3 cc. of the resulting soln. were treated with 2 cc. of 5% basic Hg sulfate (in 5%  $\text{H}_2\text{SO}_4$ ). Three drops of 0.5%  $\text{NaNO}_2$  soln. were then added and the whole was warmed to  $95^\circ$ . The intensity of the color developed is compared with that of an appropriate tyrosine soln. subjected to the same procedure (not including the deproteinization and  $\text{Et}_2\text{O}$  extr.). The tyrosine content of the serum in a series of patients varied from 2.1 to 5.3 mg. per 100 cc.

**Comparative colorimetric studies with the help of the phenol reagent of Folin and Denis and Weiss's modification of Millon's reaction.** GRO. HAAS AND WILLY TRAUTMANN. *Z. physiol. Chem.* 127, 52-66(1923).—The reagent of Folin and Denis when employed for detg. tyrosine in blood serum (cf. *C. A.* 13, 332) gives results much too high. If an attempt is made to remove uric acid by oxidation with  $\text{H}_2\text{O}_2$  in alk. soln. some tyrosine is destroyed.

**A modification of Fuld's method for the estimation of pepsin.** RICH. EGR. *Z. physiol. Chem.* 127, 125-36(1923).—See *C. A.* 17, 1651.

**The specific macro- and microchemical detection of histidine in proteins.** HERMANN BRUNSWIK. *Z. physiol. Chem.* 127, 268-77(1923).—Since tyrosine and histidine are the only amino acids which give Pauly's diazo reaction, the elimination of the former would provide a specific test for histidine. Nitration as commonly carried out in applying the xanthoproteic acid reaction serves this purpose. A variety of applications indicates the usefulness of the test. It may also be used with solid substances.

**MÜLLER, FRANZ AND SACHS, FRITZ: Medizinisch-Chemische und mikroskopische Technik.** Leipzig: G. Thieme. 113 pp.

**PINCUSSEN, LUDWIG: Mikromethodik. Quantitative Bestimmung d. Harn- u. Blutbestandteile in kleinen Mengen f. klin. u. experimentelle Zwecke.** 2d. Revised ed. Leipzig: G. Thieme. 125 pp.

**Laboratory tabulator.** C. PENAFLO. U. S. 1,460,917, July 3. The app. is adapted for differential counting of blood corpuscles.



## C—BACTERIOLOGY

A. K. BALLS

**Studies on salt action. VII. The role of certain ions in bacterial physiology.** I. S. FALK. *Abstracts Bact.* 7, 33-50, 87-105, 133-147(1923).—A bibliographic review.

E. J. C.

**The propionic acid fermentation of lactose.** J. M. SHERMAN AND R. H. SHAW. *J. Biol. Chem.* 56, 695-700(1923).—*B. acidi propionici* (d), which is concerned in the production of the qualities peculiar to Swiss cheese (*C. A.* 15, 3883) slowly ferments lactose with the formation of HOAc and EtCO<sub>2</sub>H, in the mol. ratio 1:1.7, with the total wt. of acids formed amounting, in 30 days, to 66.6% of the wt. of the lactose consumed. The rate of acid production and the ratio of EtCO<sub>2</sub>H to HOAc are increased by the presence of other organisms, such as *Streptococcus lactis*, *Lactobacillus casei*, *Proteus vulgaris* and others (cf. *C. A.* 15, 2467). *Lactobacillus casei* is most efficient in increasing the amt. of acid produced but does not greatly change the ratio, whereas an unidentified organism which does not ferment lactose and which apparently belongs to the same group as *B. alcaligenes* does not greatly increase the rate of acid production but changes the ratio of HOAc:EtCO<sub>2</sub>H to 1:11.5.

I. GREENWALD

**Notes on the lactobacilli.** J. M. SHERMAN. *Abstracts Bact.* 5, 6(1921).—Study was made of 38 strains belonging to this group, including *Lactobacillus bulgaricus*, *L. bifidus*, *L. acidophilus*, and unidentified cultures from silage, milk, cheese, and intestinal contents. The group produced acid in sugar-free media. True *L. bulgaricus* produced less CO<sub>2</sub> than the intestinal forms, and was more sensitive than the latter forms to a low temp., the presence of certain salts such as phosphates and NaCl, and an alk. medium, failing to grow below 15 or 20° or at an H-ion concn. of p<sub>H</sub> greater than 7.5 to 8.0.

JOSEPH S. HEPBURN

**Flora of corn meal.** CHARLES THOM AND EDWIN LE FEVRE. *Abstracts Bact.* 5, 10-1(1921).—While corn meal contains bacteria and molds in considerable numbers, merchantable meals very rarely show bacterial activity. However, when the moisture content exceeds 13%, spoilage by the action of *Aspergillus repens* begins; other species of molds become active when the moisture content is 16%; and both molds and bacteria are active when the moisture content is 18 or 20%.

JOSEPH S. HEPBURN

**Bacterial changes in stored human feces.** E. O. JORDAN. *Abstracts Bact.* 5, 12(1921).—An increase in bacterial count occurs, at both low (10°) and high (37°) temps. and is due chiefly, if not entirely, to proliferation of *B. coli*. This increase is evidence that an inhibitory effect obtains in the lower intestine, and is manifested even upon the characteristic microorganism of the intestinal contents of that region.

J. S. H.

**Effect of the reaction of the medium upon the morphology of the diphtheria bacillus.** R. L. LAYBOURN. *Abstracts Bact.* 5, 14(1921).—During sterilization of Loeffler blood serum medium, its H-ion concn. did not change more than 0.2 of a p<sub>H</sub> unit. Three typical granule-producing strains of *B. diphtheriae* of known virulence showed the longest forms and the largest % of granule-formation when grown on Loeffler medium of p<sub>H</sub> 7.0 or 7.5, the period of incubation being 24 hrs. at 37.5°. When the strains were grown on Loeffler medium, which was more acid (p<sub>H</sub> 5.5 to 6.5) or more alk. (p<sub>H</sub> 8.0 to 8.5), a proportional decrease occurred in both length and percentage of granule formation.

JOSEPH S. HEPBURN

**Investigation into the purity of strains of *Bacillus botulinus* obtained from different sources in this country.** GEO. F. REDDISH AND L. F. RETTGER. *Abstracts Bact.* 5, 14(1921).—A non-toxic strain (*Bacillus sporogenes*) was isolated from 18 out of 19 strains of *B. botulinus* examd. The non-toxic strains fermented glucose, levulose and maltose with gas production, while the toxic strains produced gas from these sugars and also from lactose and sucrose. When *B. botulinus* predominates in the mixed culture, toxicity is high, when *B. sporogenes* predominates, toxicity is slight; this fact has an important bearing on the production and use of antitoxin for the treatment of botulism.

JOSEPH S. HEPBURN

**Streptococcus. II. Cultural versus biological classification.** C. ROOS AND E. MAY GRAY. *Abstracts Bact.* 5, 15(1921).—Cultural methods are inadequate for the classification of pathogenic streptococci. All strains of this genus produce either hemolysis or methemoglobin to some degree. In the agglutination test, interreactions frequently occur between the hemolytic, viridans, and non-hemolytic strains of streptococci. Apparently a relationship exists between these strains similar to that between the typical and atypical strains of Type II pneumococci.

JOSEPH S. HEPBURN

**Importance of an increased carbon dioxide tension in growing *Bact. abortus* Bang.** I. F. HUDDLESON. *Abstracts Bact.* 5, 16(1921).—Growth of *Bact. abortus* is greatly

stimulated by an increased  $\text{CO}_2$  tension. For growth to occur, the atm. should contain 10% by vol. of  $\text{CO}_2$ . JOSEPH S. HEPBURN

**Hemolytic influenza bacilli.** T. M. RIVERS and ERIDA L. LEUSCHNER. *Abstracts Bact.* 5, 21(1921).—A full description is given of several strains of the influenza bacillus which are hemolytic and hemoglobinophilic. JOSEPH S. HEPBURN

**Alkali-producing organisms in scarlet fever.** R. W. PRYER. *Abstracts Bact.* 5, 22(1921).—A pathogenic organism, which probably is not a true bacterium, has been isolated from scarlet fever cases; it is characterized by a very resistant spore and the production of alkali in carbohydrate media. JOSEPH S. HEPBURN

**Adaptability of various American peptones for use in cholera mediums.** IDA M. BENNETSON. *Abstracts Bact.* 6, 34(1922).—Most American peptones are suitable for this purpose. A H-ion concn. of approx.  $p_H$  9.5 permits the growth of *Vibrio cholerae* and inhibits that of *Bacillus coli*. JOSEPH S. HEPBURN

**Further observations on a bacteriolytic element found in tissues and secretions.** ALEXANDER FLEMING and I. D. ALLISON. *Proc. Roy. Soc. London* 94B, 142-51(1922); cf. C. A. 16, 4260; 17, 143.—Strains of *Micrococcus lysodeikticus* resistant to lysozyme action can readily be developed. The resistance is not-sp.; strains resistant to 1 tissue or secretion are equally resistant to all tissues, human, lower animal, and plant. After lysis of a large number of the micrococci, the lytic power of the fluid is increased, the increase affecting wholly or mainly the homologous microbe. Lysozyme is different from the bacteriophage. JOSEPH S. HEPBURN

**Effect of mineral salts on the growth of bacteria.** C.-E. A. WINSLOW and MARGARET HOTCHKISS. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 4(1922).— $\text{NH}_4\text{Cl}$  has no stimulating action on bacterial growth, and exerts an inhibitive action in mol. concn. The other salts studied stimulate growth in high diln. and inhibit it in low diln. The concns. at which these respective actions are apparent on *B. coli* are:  $\text{CaCl}_2$  0.01 and 0.5 mol.,  $\text{MgCl}_2$  0.05 and 0.5 mol.,  $\text{SrCl}_2$  0.1 and 1.0 mol.,  $\text{NaCl}$  0.5 and 3.0 mol.,  $\text{KCl}$  0.5 and 4.0 mol. JOSEPH S. HEPBURN

**Production of tyrosine by a putrefactive anaerobe.** I. C. HALL. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 6-7(1922).—Two new bacterial species, *B. centrosporogenes* and *B. tyrosinogenes* (an obligate anaerobe), produce putrefaction of beef, salmon, casein, and milk with the formation of tyrosine, probably because they are unable to metabolize that amino acid. The blackening of certain media by putrefactive anaerobes is due to a reaction between Fe and  $\text{H}_2\text{S}$ . JOSEPH S. HEPBURN

**Cultural and biochemical study of certain known anaerobes.** GEO. F. REDDISH and L. F. RETTGER. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 7(1922).—The following conclusions are drawn from an extensive study of type strains of 12 well known anaerobes. The anaerobes fall into 5 classes:—(1) saccharolytic, non-proteolytic, non-peptolytic; (2) saccharolytic, non-proteolytic, peptolytic; (3) saccharolytic and proteolytic. (4) Slightly saccharolytic, non-proteolytic, slightly peptolytic. (5) Non-saccharolytic, strongly proteolytic. Liquefaction of gelatin is not considered a true index of proteolysis. Organisms which produce relatively large amts. of  $\text{NH}_3$  from peptone also digest meat and serum. Non-proteolytic, peptolytic organisms produce relatively little  $\text{NH}_3$  but large amts. of amino acids by their action on peptone. JOSEPH S. HEPBURN

***Clostridium putrificum* (*B. putrificus* Bienstock), a distinct species.** GEO. F. REDDISH and L. F. RETTGER. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 9(1922).—The biochem. reactions of this microorganism demonstrate it to be a distinct species; it is in a class by itself, being actively proteolytic and non-saccharolytic. JOSEPH S. HEPBURN

**Effect of potassium and magnesium salts upon bacterial viability.** C.-E. A. WINSLOW and DOROTHY F. HOLLAND. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 10(1922).—The following results were obtained with *B. coli*. A low diln. of  $\text{KCl}$  (0.01 mol.) was distinctly toxic; an intermediate concn. of  $\text{KCl}$  (0.1 mol.) or  $\text{MgCl}_2$  (0.08 mol.) distinctly favored survival and reproduction; still higher concns., e. g., 1.0 mol.  $\text{KCl}$  or 0.5 mol.  $\text{MgCl}_2$  were extremely toxic. Antagonism between K and Mg was far less marked than that between Na and Ca; the mildly toxic action of 0.58 mol.  $\text{KCl}$  was decreased, but not abolished, by addn. of 0.08 mol.  $\text{MgCl}_2$ ; 0.58 mol.  $\text{KCl}$  and 0.16 mol.  $\text{MgCl}_2$  exhibited an additive effect. The toxicity was increased when the H-ion concn. was increased to values of  $p_H$  below 7.5. JOSEPH S. HEPBURN

***Bacillus botulinus*: relation of toxin production to temperature.** RUTH B. EDMONDSON, L. T. GILTNER and CHARLES THOM. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 23(1922).—The production of toxin depends upon the nature of the medium, and the temp. and period of incubation. Toxicity is usually ac-

accompanied by definite physical signs of spoilage such as odor and production of gas.

JOSEPH S. HEPBURN

**Differentiation of hemolytic streptococci from human and dairy sources particularly with methylene blue.** R. C. AVERY. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 31-2(1922).—Study was made of 142 strains; only those of the human type yielded a hemolytic titer in plain broth. The 99 human strains produced a low final acidity ( $p_H$  5.3 to 5.0); 98 of them failed to reduce a 1:5000 soln. of medicinal methylene blue in milk. Bovine strains and those from cheese produced a high final acidity ( $p_H$  4.5 to 4.2). The 21 cheese strains reduced methylene blue; 19 of the 2 bovine strains failed to reduce that compd. Two strains, from a com. lactic starter and pasteurized milk, resp., produced high acidity and reduced methylene blue. Reduction of methylene blue may therefore serve as a tentative mode of differentiation of cheese strains of hemolytic streptococci from strains of human and bovine origin.

JOSEPH S. HEPBURN

**Production of yeast vitamin in the laboratory for the cultivation of bacteria.** A. P. HITCHENS. *Sci. Proc. Soc. Am. Bacteriologists* Nov. 1921; *Abstracts Bact.* 6, 35(1922).—Yeast is grown for at least one week at room temp. on a medium contg. strained horse blood clot 200 cc., peptone 1%, NaCl 0.5%, agar 0.07%, glucose 3%, maltose 3%, beef infusion sufficient to make 1 l.; the H-ion concn. of the medium is adjusted to  $p_H$  5.4. The yeast culture is kept at a temp. of 55° overnight, brought rapidly to a boil over a naked flame, then kept at 95° for 15 min. Seventy-five cc. of either the supernatant liquid, or the filtrate obtained from it by means of a Mandler candle, are added to 1500 cc. of beef infusion broth to obtain a medium for the rapid growth of streptococci, pneumococci, and, especially, of the influenza bacillus.

JOSEPH S. HEPBURN

**Gelatin liquefaction by bacteria.** MAX LEVINE and D. C. CARPENTER. *Sci. Proc. Soc. Am. Bacteriologists* 1922; *Abstracts Bact.* 7, 4(1923).—One group of bacteria neither hydrolyzes nor liquefies plain nutrient gelatin. A second group partially hydrolyzes and liquefies that medium; subsequent decompn. occurs slowly if at all; and the formal titration undergoes only a slight increase. A third group more completely hydrolyzes and liquefies that medium; subsequent decompn. is rapid and accompanied by a marked increase in the formal titration.

JOSEPH S. HEPBURN

**Modification of the blood agar plate.** WM. S. STURGES. *Sci. Proc. Soc. Am. Bacteriologists* 1922; *Abstracts Bact.* 7, 4(1923).—NO-hemoglobin may be used instead of fresh defibrinated blood as an enrichment for certain media, *e. g.*, those used for the differentiation of certain streptococci.

JOSEPH S. HEPBURN

**Influence of autoclave sterilization on carbohydrates in culture media.** J. G. McALPINE. *Sci. Proc. Soc. Am. Bact.* 1922; *Abstracts Bact.* 7, 5(1923).—Use was made of a buffer soln. contg. glycocholl and Na acetate and having a  $p_H$  between 6.8 and 7.0. A disaccharide was added; after heating for 15 min. at an extra pressure of 15 lbs., change in  $p_H$  was detd. colorimetrically, and the appearance of monosaccharides was detected by means of Barfoed reagent. Sucrose was relatively stable; both lactose and maltose were partially hydrolyzed, as was shown by the increased H-ion concn. and the appearance of monosaccharides.

JOSEPH S. HEPBURN

**Enzymic content of bacterial spores.** G. L. A. RUEHL. *Sci. Proc. Soc. Am. Bacteriologists* 1922; *Abstracts Bact.* 7, 7(1923).—The spores from 12 cultures of aerobic spore-forming bacteria (species not stated) contained catalase and gelatinase. Some cultures yielded positive results for lipase, caseinase and indophenol oxidase, although these enzymes were usually absent. Methylene blue reductase was always absent.

JOSEPH S. HEPBURN

**Homogeneous catalysts in the oxidation of sulfur by *Thiobacillus thiooxidans*.** J. S. JORRE. *Sci. Proc. Soc. Am. Bacteriologists* 1922; *Abstracts Bact.* 7, 8(1923).—*Thiobacillus thiooxidans*, grown on a synthetic medium contg. inorg. salts and 10 g. S per l., oxidizes S to  $H_2SO_4$  and may produce an acidity as high as 2 N. Addn. of certain salts, in concn. of 20 mg. of active element per l., influences the oxidation.  $NH_4VO_3$ ,  $K_2Fe(CN)_6$  and  $K_3Fe(CN)_6$  are toxic. Ni,  $U^{VI}$ , Cs and Zn increase the oxidation by from 20 to 40% during a period of 30 days. Th, Sr, Sn, Pb, and, to a slight extent, Mn also act as catalysts. No definite influence is exerted on the oxidation by salts of Ca,  $Cr^{++}$ ,  $As^{III}$ , Bi, Hg, Li, and the rare earths. Ni becomes toxic at a concn. of 400 mg. per l.

JOSEPH S. HEPBURN

**Utilization of organic acid salts by the colon-aerogenes group.** S. A. KOSER. *Sci. Proc. Soc. Am. Bacteriologists* 1922; *Abstracts Bact.* 7, 8(1923).—The Na salts of various org. acids were used as the sole source of C in a synthetic medium composed of inorg. salts. The salts of AcOH, succinic, malic, lactic, mucic and glyceric acids produce abundant growth of colon-aerogenes strains, while those of valeric and isovaleric,

caproic, oxalic, salicylic, and phthalic acids failed to support growth. Tartaric acid was readily utilized by some, but not all, strains of *B. aerogenes*, but not by *B. coli*. BzOH supported faint growth of a few *B. aerogenes* strains. Citric acid, as its K, Na, or NH<sub>4</sub> salt, did not support growth of *B. coli*, but produced a luxuriant growth of *B. aerogenes* accompanied by an increase in H-ion concn: from between  $p_H$  6.7 and 6.8 to between  $p_H$  8.4 and 9.0. When the concn. of the citrate radical exceeded that in 0.5% Na citrate soln., development was retarded; when the concn. of the radical was less than that in 0.1% Na citrate soln., insufficient available C was present. The ability to utilize citrates was not readily gained or lost by bacteria. J. S. H.

**Sugar-free medium for fermentation studies.** ELLA M. A. ENLWS. *Sci. Proc. Soc. Am. Bacteriologists 1922; Abstracts Bact. 7*, 8-9 (1923).—The medium has the following compn.: Witte peptone 10 g., K<sub>2</sub>HPO<sub>4</sub> 17 g., agar 2 g., tap water sufficient to make the total vol. 2 l., bromothymol blue sufficient to act as an indicator. After adjustment of the  $p_H$  by addn. of NaOH, 0.5% of the substrate (a sugar, polyhydric alc., or glucoside) is added; and the medium is sterilized by the fractional method. J. S. H.

**Reaction of medium and growth of Azotobacter.** U. YAMAGATA AND J. K. WILSON. *Sci. Proc. Soc. Am. Bacteriologists 1922; Abstracts Bact. 7*, 85 (1923).—Study of samples of soil from 12 districts in Japan indicated that the reaction of the soil is important in detg. what type of *Azotobacter* may be present. The  $p_H$  of the medium producing the greatest increase in cells was 6.6 for the *beijerinckii* type, 6.8 for the *chroococcum* type, and 7.0 for the *vinelandii* type. JOSEPH S. HEPBURN

**The bactericidal action of several metallic compounds of tryptaflavine.** MAX BERLINER. *Berl. klin. Wochschr.* 58, 177-8 (1921).—Tryptaflavine-Cd kills streptococci at a diln. of 1:800,000 in 24 hrs. and tryptaflavine-Au kills at 1:600,000. These 2 substances kill staphylococci at a diln. of 1:150,000 and 1:200,000, resp. The bactericidal action of argoflavine, tryptaflavine-Cu and diaminoacridine-Ag against staphylococci or streptococci does not extend over 1:150,000. There is no difference between the action of argoflavine and the same compd. without the Me group. JULIAN H. LEWIS

**Bacterial poison, especially the soluble poisons of dysentery, typhoid and paratyphoid bacilli.** III. MASAOKI YOSHIOKA. *Z. Immunitäts.* 36, 395-418 (1923).—Dysentery, typhoid and paratyphoid A and B bacilli produced sol. poisons which were markedly toxic for rabbits and much less so for guinea pigs. These were produced in 1-3 wks. growth in a broth consisting of 1% peptone plus Fukahara soln. Lethal doses for 1-kg. rabbits were as follows: dysentery 0.005-0.0025 cc., typhoid and paratyphoid B 0.05, paratyphoid A 0.1 cc. Chronic poisoning with typhoid and paratyphoid poison caused death of rabbits after some weeks with marked emaciation. The changes caused are all similar to those produced by bacillary exts. of these bacilli. E. R. LONG

**The fat-splitting enzymes of bacteria.** L. MICHAELIS AND Y. NAKAHARA. *Z. Immunitäts.* 36, 449-62 (1923).—Lipolytic activity of bacteria can be recognized by the use of the stalagmometric method with tributyrin. Fat-splitting activity among the pathogenic bacteria was noted in the case of the pyogenic cocci and the tubercle bacillus, but not in the diphtheria bacillus, pneumococcus or bacilli of the colon group or hay bacillus. A saprophyte with marked lipolytic power was most active in a range of  $p_H$  from 7.2 to 9.0, while the lipase of yeast was most active between 5.8 and 6.2. E. R. LONG

**Information concerning some microbiological works in progress.** GIACOMO ROSSI, E. CALENDOLI, C. COLIZZA AND E. PALMIERI-NUTI. *Ann. scuola agr. Portici* [2], 15, 1-12 (1920).—I. Preliminary notes on the microbiology of the soil and on the possible existence in it of invisible germs. Cf. *C. A.* 16, 2950. II. New studies on the fermentation of tobacco. Non-chem. III. A mucous alteration of pharmaceutical pastilles. Pastiles of KClO<sub>4</sub>, codeine, rhubarb, etc. are subject to the formation of dark spots of a muculent consistency which may spread and invade the entire pastille. The more rapid change in summer, the contagiousness and the securing of agar streak cultures which could serve in turn as an inoculating material indicate a mucous type of fermentation at the expense of the starch and sugar analogous to that of mucous bread, which is due to *B. licheniformis* and *B. mesentericus vulgaris*. IV. New studies on *Bacillus coli*. Inoculation in peptonized H<sub>2</sub>O and Eijkmann's liquid indicate that *B. coli* is far from being as abundant in soils (even manured) as commonly stated. V. Mode of action of aerobic pectic ferments. To det. whether pectic ferments act through endo- or ectoenzymes living cultures were sepd. from their products by porous filters under the pressure of a Gay-Lussac pump. The sterile filtrates were made to act on pieces of potato or hemp which had been sterilized without the use of heat. The results were: (A) Filtrates from impure cultures. (1) Those from the maceration

of potatoes were mostly active on pieces of potato. (2) If heated at 100° for 30 min. on a water bath they lost all action. (3) They easily lost all macerating power even at ordinary temps. (4) They act even on potatoes sterilized by cooking. (5) They are inactive on sterile hemp whether uncooked or sterilized by heat. (6) The liquor from R.'s process for the retting of hemp, when filtered, though inactive on uncooked sterile hemp and that sterilized by heat, were rather active on uncooked potato. (B) Filtrates from pure cultures. (1) The filtered liquors from hemp, retted by means of *B. comesii* without access of air, were inactive towards raw or heat-sterilized hemp and towards potatoes. (2) Those from similar retting in a current of air are likewise inactive. (3) The inactivity is not modified by rendering the liquor alk. or acid, or by the addition of glycerol, or by carrying out the filtration in a current of illuminating gas.

ALBERT R. MERZ

**Utilization of atmospheric nitrogen by *Saccharomyces cerevisiae*.** E. I. FULMER. *Science* 57, 645-6(1923).—The yeast used in this study was plated out from a Fleischmann yeast cake; it is known as *S. cerevisiae*, Race F. The cultures used had been subcultured for 3 years in Medium E (cf. C. A. 15, 694). The yeast was then subcultured for 6 mo. in Medium C, which contained no Ca or Mg, and this yielded a yeast, the ash of which was free from those elements. This latter yeast was inoculated into a series of flasks contg. in each 100 cc. of medium: sucrose 10 g.,  $K_2HPO_4$  varying amts. but the optimum was 0.45. Cond. water was used as a solvent. The flasks with their contents were sterilized under pressure and while still hot were furnished with rubber stoppers carrying 2 tubes. Air freed from  $NH_3$  and oxides of N was bubbled through the contents of each flask. The results show that yeast will grow continuously in a medium composed of sucrose and one salt. *S. cerevisiae* will grow in an apparently good state of nutrition using atm. N as the sole source of that element. It may be that the benefits accruing from the aeration of yeast cultures is as much due to the addn. of N as of O.

L. W. RIGGS

**A review of the present problems and methods of agricultural bacteriology.** CHRISTIAN BARTHEL. *Knute and Alice Wallenberg Foundation, Publication* 1, 116 (Stockholm) (1923).—A report of the author's visit to the principal laboratories of agricultural bacteriology in America and in Europe in 1922, together with a general discussion of the recent researches in this field. There are numerous illustrations and a bibliography of 67 titles.

J. J. WILLAMAN

ELLIS, DAVID: **Practical Bacteriology for Chemical Students.** London: Longmans, Green & Co. 136 pp. 4s. 6d. net.

## D—BOTANY

B. M. DUGGAR

**Can any relation be derived between the amount of bases in the ash and the nitrogen content of plants which permits of any conclusion concerning the type of nourishment and extraction?** H. ZIEGENSPECK. *Ber. botan. Ges.* 40, 78-85; *Chem. Zentr.* 1922, III, 59-60.—In view of the observation of Stahl (*Jahrb. wiss. Bot.* 34, 39) that mycotrophic plants often have a very low ash and that independently living plants utilize N almost exclusively as nitrates, the attempt was made to det. the manner of N assimilation and the degree of salt excretion by converting the N content into its base equiv. The N content is given in terms of K in tables. Mycotrophic plants probably absorb from the soil their N not in the form of nitrates but as  $NH_3$  compds. at least, if not as amino acids. The N-base ratio can be considered a measure of the degree of saprophytism of the plant.

C. C. DAVIS

**The action of chlorine and certain vapors upon the higher plants.** P. GUÉRIN. *Ann. sci. agron.* 38, 10-19(1921); *Botan. Abstracts* 12, 248.—The literature is briefly reviewed and the results of a series of expts. on many genera and species of higher plants with  $Cl_2$ , chloromethyl chloroformate, bromoacetone, mustard gas,  $CHCl_3$ ,  $Et_2O$ ,  $EtCl$ , several alcs., phenols, and aldehydes are reported.  $Cl_2$  gas was most severe in its action, causing the plants to lose their leaves. In other cases the effects varied from a slight bleaching to a blackening of the leaves. The effect of the treatments is a plasmolysis, which was proved by microscopic examn. of affected tissue and by the reddening of Na picrate papers suspended in vessels above treated plants. It is claimed that in the plasmolytic action HCN liberated by the action of emulsin on a glucoside acts on the paper. Certain odors emanated by some plants during treatment are noted as further evidence of plasmolysis.

H. G.

**The physiology of calciphobous plants.** WALTER MEVIUS. *Jahrb. wiss. Bot.* 60, 147-83(1921); *Botan. Abstracts* 12, 230.—No harmful effects due directly to Ca were

noted upon the growth of *Sphagnum rufescens*, *S. fimbriatum*, *S. imbricatum*, and *S. quinquefolium*.  $\text{CaCO}_3$  caused injury and death of *Sphagnum* because of its alk. reaction. When the free alkali is neutralized no such injury occurs. Phosphates caused injury, but their poisonous action could be corrected by  $\text{KNO}_3$  and  $\text{MgSO}_4$ . Ca was found to be unquestionably necessary for the growth of *Pinus pinaster* and *Sarothamnus scoparius*; the lack of Ca caused the roots of the latter to rot, and it resulted in shoot-tip injury to the former. The behavior of both these plants toward OH ions was similar to that of *Sphagnum*. In strong concns. these ions caused a great decrease in growth and a destruction of roots in both plants. Weak concns. caused chlorosis. The concns. causing definite injury were different for each species. A bibliography is appended.

H. G.

**Study of the secretion of lupulin by the glands of cultivated hops.** F. MORREAU AND MME. F. MOREAU. *Rev. gén. Bot.* 34, 193-201(1922); *Botan. Abstracts* 12, 235.—During the development of the lupulin glands, 3 groups of substances may be recognized in the cells: lipoids, tannoids, and the essences and resins. A special procedure was used in the case of the lipoids owing to their soly. in alc., benzine, toluene, xylene, or other substances used in fixation and imbedding. During the growth of the gland the lipoids were observed in the cytoplasm in the form of granules and filaments, present from the beginning, becoming more and more abundant up to the time of the spreading of the disk and cup, then diminishing in quantity in the later stages. The tannoids on the other hand occur in the vacuoles. They are present in soln. in the young stages, then appear as threads or a network, later becoming more voluminous, and they persist even in the older glands. The essences and resins were not found in the young glands, which were rich in lipoids but they became abundant in the later cup stage. These products are present in the cytoplasm between the vacuoles contg. the tannoids or around the large tanniferous central vacuole, always as globules larger than the granular lipid bodies. Because of these associations the authors are inclined to consider that the essences and resins are elaborated from the lipoids or, if the relation is not so close as this, at least the lipoids react with the protoplasm to modify permeability so as to allow the passage of the essences and resins into the subcuticular cavity of the gland. H. G.

**Relation between permeability variation and plant movements.** BASISWAR SEN. *Proc. Roy. Soc. London* 94B, 216-31(1923).—The elec. resistance of a plant tissue serves as a measure of the number of free ions outside the protoplasmic cell membranes; in a stimulated tissue, the number of ions increases in a marked degree as a result of the increased permeability of the membrane. This holds true for the motile pulvinus of *Mimosa pudica* and the stems and petioles of *Helianthus annuus*, *Bryophyllum* and *Raphanus*. The observed effects are physiol.; variation of resistance does not occur in dead or killed tissue. The amplitude of the mech. response of the *Mimosa* leaf closely corresponds to the decrease in resistance of the pulvinus. JOSEPH S. HEPBURN

**Recent advances in science—Plant physiology.** R. C. KNIGHT. *Science Progress* 17, 564-9(1923).—Review of recent work on the physiol. action of fungicides.

JOSEPH S. HEPBURN

**The pigment of the alga *Palmelloccoccus miniatus*, Chod., var. *porphyrea*, Wille.** K. BORESCH. *Ber. botan. Ges.* 40, 288-91(1922).—The water-sol. pigment which occurs in a species of *Palmelloccoccus* found growing in moist places in the Botanical Garden in Prague and identified by Wille as *P. miniatus*, Chod., var. *porphyrea*, was identified by its absorption spectrum and reactions as a mixt. of phycocyanin, and the phycocerythrin characteristic of the Schizophyceæ. The identity of the pigments in such widely sepd. groups of algae points to the common chemico-physiol. relationship of plants.

J. C. S.

**Phycocerythrin in the myxophyceæ.** N. WILLE. *Ber. botan. Ges.* 40, 188-92(1922).—The occurrence is recorded of a phycocerythrin in a species of Myxophyceæ, identified as *Phormidium persicinum* growing 3-4 fathoms deep off the south coasts of Norway, which gives an absorption spectrum identical with that of the phycocerythrin found in the Floridææ, and is undoubtedly identical in other respects with that substance. A phycocerythrin has already been detected by Borsch in other species of Myxophyceæ, but this was apparently different from the coloring matter of the Floridææ, as it showed only one absorption band in the green, while the coloring matter of *P. persicinum* shows 3 bands, that near the F line being particularly characteristic of the phycocerythrin of the Floridææ.

J. C. S.

**The diurnal pigment changes in *Selaginella serpens* Spring.** KARL SUSSINGRUTH. *Biol. Zentr.* 43, 123-9(1923).—Polemical with earlier authors. W. A. PERLZWEIG

**The latent period of seeds treated with Röntgen rays.** FRIEDL. WEBER. *Wiener klin. Wochschr.* 36, 147-8(1923).—The growth-inhibiting effect of a definite amt. of

X-ray treatment upon air-dried seeds of *Vicia faba* is the same whether the seeds are allowed to germinate after radiation or after a longer passive latent period up to 5 months, as measured by the total length of stalk plus main root stem. The duration of the passive latent period is without any apparent influence upon the active latent period. The primary injury of the cell nucleus by X-rays can be effected while the latter is in a totally resting stage and is not undergoing any mitotic division. This injury is not in any way counteracted or healed during long periods of passive rest.

W. A. PERLZWEIG

The Röntgen-ray susceptibility of different varieties of a plant genus. EUGEN PETRY. *Wiener klin. Wochschr.* 36, 345(1923).—On subjecting several varieties of seeds of the same plant genus to uniform conditions of Röntgen radiation no significant difference in susceptibility (as measured by the retardation in subsequent growth) of the varieties of most plants was found. There is an exception in the yellow and red varieties of lentil seeds; in these, after radiation, the red is much more retarded in growth than the yellow variety. A possible analogy with the frequently observed super-susceptibility of red-blond (Titian-red) human individuals to X-rays is discussed.

W. A. PERLZWEIG

Influence of solar radiations on the development of belladonna and on its alkaloidal content. H. DELUARD. *Bull. sci. Pharmacol.* 30, 11-5(1923).—One lot of belladonna was grown in full sunlight, another lot in the shade, all other conditions being as nearly uniform as possible. Plants in the sunlight furnished 2 crops of leaves the first year and 3 crops the second year. Plants in the shade furnished 1 and 2 crops, resp. Powdered leaves from plants in the sun yielded an av. of 0.66 g. of alkaloid per 100 g. of powder at the first collection and 0.52 g. at the second collection. Plants in the shade yielded an av. of 0.39 g. in the one collection. Plants grown in the shade for 3 months, then placed in the sun for 6 weeks resembled in alkaloidal content those grown continuously in the shade. The amt. of ext. furnished by the powder was greater for plants grown in the sun and taken from the second collection. The amt. of alkaloid in the ext. from isolated plants was for plants grown in the sun 2.65 to 2.79%, and from shaded plants 1.24 to 2.47.

L. W. RIGGS

Erythrodextrin in maize. J. H. KEMPTON. *Science* 57, 556-7(1923).—Statements by Weatherwax (*Genetics* 7, 568-72) and by East (*Science* 57, 416-8) are reviewed. The iodine test has made possible the identification of the double recessive combination of waxy and sweet obtained in the  $F_2$  hybrids between the waxy type and varieties of sweet corn.

L. W. RIGGS

Permeability of living and dead cells. I. Quantitative observations on the penetration of acids into living and dead cells. MATILDA M. BROOKS. *U. S. Pub. Health Repts.* 38, 1449-70(1923).—In this study of penetration of acids into a living cell the surrounding medium was always sea water to which a trace of acid had been added, thus insuring the presence of the same cations in the same proportion. The acids were used in such concns. as to give a  $p_H$  of 3.6. The marine alga *Valonia ventricosa* J. Agardh, obtained about 3 m. below low tide along the Florida Keys, was selected for this study. It is a single cenocytic cell with a large vacuole contg. sap in amts. sufficient for accurate analyses. Outside of this vacuole is a delicate layer of protoplasm contg. many nuclei, chloroplasts, etc., and this in turn is inclosed in a thin, tough external wall. The size ranges from small plants to those contg. 25 to 50 cc. of sap. By noting the  $p_H$  at various intervals after immersing the cell in an acid soln. the entrance of the acid can be readily detected. Hard-glass test tubes were used. Each cell was wiped with filter paper until dry. A hole was made through the cell wall by means of a pointed glass rod and the cell sap, being under pressure, readily came out. The cell contents were not allowed to spray through the air because  $CO_2$  would be lost, causing a change in the  $p_H$  of the sap. Distd. water was not used for rinsing because of its influence on the internal pressure of the cell. Cells placed in distd. water ruptured within 10 min. The  $p_H$  of healthy plants was generally between 6.2 and 6.4 when the free  $CO_2$  was not removed and between 6.6 and 6.8 after its removal. Dead cells have the same  $p_H$  as sea water, which at Miami, Fla., was 8.6. *Valonia* is very sensitive to changes in osmotic pressure. Care was, therefore, taken to change the osmotic pressure as little as possible by maintaining the sea water at a  $p_H$  of 3.6 by the addn. of sea water or traces of acid. Combined  $CO_2$  (bicarbonate) present in the cell sap before exposure of the cell to the acid soln. exerts a marked effect on the apparent rate of change of  $p_H$  of the cell sap, which does not fall below  $p_H$  5.2 until the bicarbonate has all been displaced by the entering acid. This factor, which probably affects protoplasm itself, has heretofore been entirely neglected. The acids studied may be divided into 2 groups, (1) those which liberate  $CO_2$  and (2) those which do not. The first group includes the min-

eral acids, oxalic, citric, tartaric and the 3 chloroacetic acids. These appeared to penetrate more slowly than they actually do. The second group includes acetic, salicylic, butyric and benzoic acids, which are unable to replace  $\text{CO}_2$  (or but slightly), and penetrate with great rapidity. Living protoplasm is not the only agency regulating the rate of penetration of acids, since dead cells behave somewhat like those which are alive.

II. Penetration of alkali bicarbonate into living and dead cells. *Ibid* 1470-7.—Living cells of *Valonia ventricosa* are exceedingly permeable to carbonic acid. When they are placed in sea water contg. alkali bicarbonates, a membrane hydrolysis occurs, carbonic acid entering the cell rapidly. At the same time there is an increase in the alky. of sap freed from  $\text{CO}_2$ , presumably due to the penetration of alkali ions. The addn. of  $\text{KHCO}_3$  to sea water makes both the entrance of carbonic acid and the increase in alky. more rapid than does the addn. of  $\text{NaHCO}_3$ . These processes do not occur in dead plants. Citrate, acetate, and chloride anions do not produce so great an increase in the alky. of the  $\text{CO}_2$ -free sap, but also show the greater influence of the K ion over Na in producing the alky.

L. W. RIGGS

The influence of chemical fertilizers on the chlorophyll coefficient. JEAN WLODEK. *Bull. acad. polonaise sci. let. classe sci. math. nat.* (B) 1920, 19-52.—Detms. were made of the chlorophyll coeff., neochlorophyll (A): allochlorophyll (B) (Willstätter's Chlorophyll a and b) by comparing the limits of the absorption bands by means of a Wagner spectrometer (*Z. Instrumentenk.* 1913, 149). The live leaves of potato and sugar-beet were studied, grown in soils to which various fertilizers were added: (1) without fertilizer, (2) P, K and N; (3) P and N, but no K, (4) P, N, Mg, no K, (5) K, N, no P, (6) P, K, no N. It is concluded that after a certain period of development of the plants the relation of the chlorophyll pigments varies during the course of 24 hrs.; B increases during the day and A during the night. The lack of K results in an absolute and relative diminution of B and an increase in A, as well as a reduction of the daily variation of the two components. Lack of P also reduces the daily variation of the chlorophyll components and narrows the absorption bands; N tends to reduce A and augment B. The action of Ca and Mg is not definitely established.

H. A. SPOERER

The influence of light and of chemical fertilizers on the chlorophyll coefficient. JEAN WLODEK. *Bull. acad. polonaise sci. let. classe sci. math. Nat.* (B) 1921, 143-90; cf. preceding abstract.—The variations of the chlorophyll coeff. in *Iris germanica* under the influence of light with attached and excised leaves were studied. During illumination the absorption bands shift toward the more refrangible portion of the spectrum and in the opposite direction in the dark. In illuminated leaves the absorption band of allochlorophyll becomes wider, that of neochlorophyll narrower, while the reverse happens in the dark. This change requires  $\frac{3}{4}$ -2 hrs. The shifting of the absorption band is noticeable after 15 min. Leaves which have died through wilting show an increased chlorophyll coeff. and a shifting of the absorption band towards the violet. Ether diminishes the variations in the chlorophyll coeff. In endeavoring to relate the chlorophyll coeff. to mineral nutrients of oats, barley and beans, it was found that with a lack of K the coeff. diminishes at a certain phase of development of the plants. This is due to an increase of the absorption band of neochlorophyll and a decrease in that of allochlorophyll, as compared with plants grown under normal conditions. A lack of N in the soil increases the chlorophyll coeff. A relation seems to exist between the width of the first absorption band and the N content in fresh bean leaves, in the straw and harvest of oats and barley. The N content increases with the width of the band. With a lack of K the chlorophyll coeff. does not change under the influence of light and dark. In leaves which show an abnormal chlorophyll coeff. the production of vegetative material is less.

H. A. SPOERER

Mannitol from Orobancha cumana. A. KIESSEL. *Z. physiol. Chem.* 126, 257-60 (1923).—The plants employed were parasitic upon *Helianthus annuus*, which contains no mannitol. The mannitol, which is present in the parasites up to 20%, must, therefore, be formed by the reduction of carbohydrates derived from the host.

R. L. S.

Chemical constituents of green plants. XXV. Acids of the apple (*Pirus malus*). H. FRANZEN AND FRITZ HELWERT. *Z. physiol. Chem.* 127, 14-38 (1923); cf. C. A. 17, 2442.—The acids of the apple consist principally of malic acid along with a relatively large amt. of citric acid; small amts. of succinic acid and lactic acid, a very small amt. of oxalic acid and traces of unsatd. acids also are present.

R. L. STEHLK

Chemistry of the higher fungi. XVII. *Amanita muscaria* L., *Inoloma albivolaecum* Pers., *Boletus satanas* Lenz. and *Hydnum versipelle*. LUCIE BARD AND JULIUS ZHILLNER. *Monatsh.* 44, 9-17 (1923); cf. C. A. 15, 2111.—A method is described for the investigation of the colloidal polysaccharides of fungi. *Amanita muscaria* L. contains glucose, 1.76%; mannitol, 6.02; mycetide, 7.40; viscosin, 5.43; the



last 2 are colloidal, and contain 0.86% pentosans and 0.62% methylpentosans. The carbohydrate insol. in hot  $H_2O$  was sepd. into a difficultly hydrolyzable fraction (crude fiber), which contained: chitin, 3.50%; cellulose-like products, 7.20; and a more readily hydrolyzable portion, which contained 0.92% pentosans, 0.55% methylpentosans and 20.16% insol. membrane material. The petroleum ether ext. of *Inoloma albobolaccum* Pers. is a dark, salve-like mass, with acid no. 123 and sapon no. 128. The principal fatty acids found were oleic and palmitic. The unsapon. matter contained ergosterol- and cerebrin-like substances. The alc. ext. contained a small amt. of mycose, glucose, and probably choline. The petroleum ether ext. of *Boletus satanas* Lenz has an acid no. of 118, sapon. no. of 202 and contains 7.4% unsapon. matter. The satd. fatty acid is palmitic, the unsatd. principally oleic with some linoleic acid. Lecithin is present. The  $Et_2O$  ext. contained ergosterol, m.  $164^\circ$  and a cerebrin-like substance, m.  $135^\circ$ .  $EtOH$  exts. phlobaphene-like compds., mannitol, choline and possibly muscarine. KCl is also found as such in the fungus.  $Et_2O$  exts. from *Hydnum versipelle* an amorphous resin, easily sapon. by  $EtOH-KOH$ .  $EtOH$  exts. mannitol, glucose and choline.  $H_2O$  exts. amorphous carbohydrates, which yield glucose on hydrolysis.

C. J. WEST

Comparative plant chemistry. V. *Alchemilla alpina* L. HANS VOGEL. *Monatsh.* 44, 19-28(1923); cf. C. A. 17, 1822.—The deep green petroleum ether ext. of the stems and leaves of *Alchemilla alpina* gives a rather solid cake having an acid no. of 20, a sapon. no. of 105.6, I no. of 51, and contains 54.3% unsapond. matter. By means of  $AcMe$  and  $EtOH-C_6H_6$  a hydrocarbon,  $C_{21}H_{34}$ , m.  $70^\circ$ , satd. and optically inactive, is obtained, together with a dark green oil, having an acid no. of 30.8, sapon. no. 141.6, I no. 75.2 and contg. 31.17% unsapond. matter. The acids obtained upon sapon. appear to be a mixt. of about equal parts of oleic and linoleic.  $C_3H_5(OH)_2$  could not be detected, but  $H_3PO_4$  was present (lecithin?). The  $Et_2O$  ext., repeatedly purified by various methods finally yields a resin-like amorphous compd.,  $C_{21}H_{34}O$  (?), darkens  $240^\circ$ , decomp.  $253^\circ$ ,  $[\alpha]_D 41.49$  ( $AcOH$ ). It does not add I, gives an amorphous  $Ac$  deriv., m.  $164^\circ$ , if heated with  $Ac_2O$  for a short time, or m.  $138^\circ$  if heated for a long time and a yellow amorphous nitro deriv., m.  $206^\circ$ . Phlobaphene was isolated from the  $EtOH$  ext., as well as tannins which belong to the group giving a green color with  $FeCl_3$  and show the reactions of the protocathechuic tannins. By means of  $Pb(OAc)_2$  the tannins were sepd. into a powdery and a sirupy fraction. Various color and pptn. reactions are recorded. Alkaloids appear to be absent; choline was pptd. by  $KI-HgI_2$ ;  $FeCl_3$  indicated the presence of phenols, and there is considerable glucose with a little fructose.  $H_2O$  exts. only mineral salts and amorphous carbohydrates. The ash content is 7.03% of the dry wt. of the plant. VI. The fruit of *Gleditschia triacanthos* L. BINEM ASZKENAZY. *Ibid* 1-8.—The petroleum ether ext. of the seeds yields a yellowish green fatty oil, acid no. 5.9, sapon. no. 190.53, I no. 120.1, unsapond. matter 3.54%,  $d_4 0.943$ ,  $n_{20} 1.4721$ . Oxidation expts. showed that the oil contained principally fatty acids of the oleic and linoleic series; only very small amts. of satd. acids were present and linolenic acid was entirely absent. The *phytosterol*,  $C_{27}H_{48}O$ , 0.5  $H_2O$ , m.  $152-3$ , is optically inactive, adds 4 I and gives an *Ac* deriv., m.  $164^\circ$ . The  $EtOH$  ext. is small in amt., has a sweet taste, an acid reaction, reduces Fehling soln., and is optically active. No definite compds. were isolated. The proteins were not investigated, though it was shown that these are located in the cotyledon and not the endosperm. Quant. expts. gave:  $Et_2O$  ext., 4.08%;  $H_2O$ -sol., 30;  $H_2O$ -sol. ash, 3.3; crude fiber, 11; pentosans, 7.95; total ash, 3.78; crude protein, 22.8; starch, 0. Similar expts. on the husks gave:  $Et_2O$  ext., 1.67%;  $EtOH$ -sol., 26;  $H_2O$ -sol., 3.43; sol. ash, 1.05; total ash, 4.11; crude fiber, 37.78; crude protein, 7.81; pentosans, 12.41. The husks were extd. with  $EtOH$ . The extd. material was then stirred with  $H_2O$  and the insol. portion extd. with petroleum ether, giving a dark oil, quickly hardening, with sapon. no. 106.5, I no. 48. The  $Et_2O$  ext. was a black resinous mass. The  $EtOH$  ext. consisted principally of a phlobaphene, reddish brown powder; melting with  $KOH$  gave a soln. showing the reactions of pyrocatechol, though this could not be isolated as such. The aq. ext. is rich in tannins and also contains glucose.

C. J. WEST

The resinous exudation of rosewood. M. B. WELCH. *J. Proc. Roy. Soc. N. S. Wales* 56, 233-40(1923).—Rose wood timber exudes a resinous oily matter that tends to destroy its polish, which has resulted in its discard by furniture manufacturers. The exudation is non-uniform in its occurrence. Steam distn. yields an oil, possessing an unpleasant smoky smell and amounting to 3.42% on air-dried timber. The structure of the heart-wood is shown in 4 photomicrographs.

W. H. BOYNTON

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## E—NUTRITION

PHILIP B. HAWK

## NORMAL

**The vitamin problem.** FRANZ GROEBBELS. *Klin. Wochschr.* 1, 2130-1(1922); cf. *C. A.* 17, 129, 2595.—Mice fed exclusively on polished rice meal gain wt. rapidly and show an increased O consumption during the first few days (first stage). Continued feeding of the vitamin-deficient diet leads to a rapid loss in body wt. and to a decreased O consumption (second stage). Feeding hay in the first stage leads to a loss in body wt. and a decreased O consumption. When hay is fed in the second stage, body wt. and O consumption are increased.

MILTON HANKE

**Indices of nutrition.** The application of certain standards of nutrition of 506 native white children without physical defects and with "good" or "excellent" nutrition as judged by clinical evidence. T. CLARK, E. SYDENSTRICKER AND S. D. COLLINS. *U. S. Pub. Health Repts.* 38, 1239-70(1923).—A comparison of the Wood (height-wt.-age tables), Dreyer (stem length-chest circumference) and Pirquet (pelidisi) standards as indices of nutrition. Of 506 children in good health, 20, 13, and 17%, resp., as measured by above standards were undernourished.

H. B. LEWIS

**Clinical studies of urine secretion in children in relation to the water content of the food.** EDMUND NOBEL. *Wiener klin. Wochschr.* 36, 321-2(1923).—The relations of the actual and potential H<sub>2</sub>O content of the food upon the quant. diurnal distribution of urinary secretion in children were studied. It was shown that effect the of added salt in inhibiting or promoting diuresis depends upon the total H<sub>2</sub>O intake. Notable differences in the diurnal distribution and total quantity of urine excreted between boys and girls were observed.

W. A. PERLZWEIG

**"Role of vitamins in the chemistry of the cell."** Reply to Abderhalden. W. R. HESS. *Z. physiol. Chem.* 127, 196-8(1923); cf. *C. A.* 16, 2523, 3492; 17, 129.

R. L. STEHLE

**The chemical nature of vitamin D.** UMETARO SUZUKI AND B. SUZUKI. *Proc. Chem. Soc. (Japan)*; *J. Chem. Soc. (Japan)* 44, 228(1923).—From oryzanin (vitamin B) by use of Al cream and the other pptg. agents, was sepd. vitamin D, which promotes bacterial growth. On acid hydrolysis, large amts. of "α-acid" was obtained. It is believed that D is a partial decompn. product of B. Thus B acts both on higher animals (anti-polynneuritis factor), and on lower organisms (bacterial growth factor), while D acts only on the latter.

S. T.

## ABNORMAL

**Metabolism of fats. I.** Action of the isolated liver from the fed and the fasting dog upon the fats and phosphatides contained in it and in the circulating blood. W. LOMBROSO. *Ann. clin. med.* 11, 78-95(1921); *Physiol. Abstracts* 7, 366-7.—When the isolated liver from a fasting dog was perfused with blood, the total fat content of the liver increased slightly while that of the blood showed a corresponding decrease; fat, added to the blood, was also stored in the liver. When the liver was isolated from a dog at the height of digestion, both its fat and any fat which was added to the blood were rapidly metabolized.

JOSEPH S. HEPBURN

**The study of incomplete nutrition. II.** Total solids and various nitrogenous constituents of the blood of pigeons fed polished rice and of starved pigeons. S. RACCHUSA. *Ann. clin. med.* 11, 271-8(1921); *Physiol. Abstracts* 7, 362.—The total solids content of the blood was slightly higher in pigeons on a diet of polished rice and was lower in starved pigeons, which received only water, than in normal birds on a mixed diet. The ratio of N to total solids greatly decreased in the blood of pigeons fed polished rice and greatly increased in that of starved pigeons. The amino acid N content of the blood increased in both conditions. **III.** Changes in the blood fat of animals incompletely nourished or starved. C. CIACCIO AND G. IEMMA. *Ann. clin. med.* 11, 280-70(1921); *Physiol. Abstracts* 7, 362.—Starvation of pigeons for 3 days produced a considerable increase in neutral fat and phosphatides; continued starvation caused a marked loss of fat and especially of phosphatides. Starvation of dogs for 6 days slightly increased the total fat and decreased the phosphatides. A vitamin-free diet produced a marked increase of phosphatides and a somewhat less marked increase in total fat in pigeons; it gave rise to a decrease in phosphatides and an increase in total fat in dogs.

JOSEPH S. HEPBURN

**The size of the parathyroids of rats and the effect of a diet deficient in calcium.** ETHEL M. LUCE. *J. Path. Bact.* 26, 200-6(1923).—Rats on a Ca-deficient diet showed a consistent enlargement of the parathyroid gland, which is due to hyperplasia and not to cell hypertrophy and which increases progressively with the length of time of Ca-deficient-feeding. There was no relationship to sex. JOHN T. MYERS

**Experimental xerophthalmia.** RICHARD WAGNER. *Arch. expul. Path. Pharm.* 97, 441-53(1923).—Rats fed upon a diet lacking in vitamin A showed sp. eye changes in about 8 to 9 weeks, with a retardation of growth appearing after 8 to 10 days. The wt. of such rats reached only about 100 g., and about 60 to 70% of the animals showed the characteristic eye symptoms. When in addition to the A deficiency the rats were fed with thyroid tissue the wts. rarely went higher than 70 g., the eyes of 100% became involved within 3 to 4 weeks, and all died within a short time. There appears to be a distinct relationship between the endocrine glands and deficient diets in so far as metabolic processes are concerned. G. H. S.

**Therapeutic feeding experiments in tuberculosis of infants.** I. RICHARD WAGNER. *Z. Kinderheilk.* 35, 127-51(1923).—II. WILLIAM HAPF AND RICHARD WAGNER. *Ibid* 152-75.—In infants, as in rats, a deficiency of vitamin A inhibits growth, and in tuberculous children such a deficiency has an unfavorable effect upon the disease process, while the abundant administration of the A factor tends to overcome the tuberculosis. G. H. S.

**The purine bases of the urine on a purine-poor diet.** (A contribution to the question of the origin and treatment of gout.) H. STEUDEL AND J. ELLINGHAUS. *Z. physiol. Chem.* 127, 291-8(1923); cf. *C. A.* 17, 1984.—The urine contains heteroxanthine, paraxanthine and 1-methylxanthine but none of the purine derivs. contained in nucleic acid. The methylated xanthines found are attributed to the coffee of the diet. It is suggested that gout is due to such a change in the intestinal flora that the purines are no longer destroyed there as they are normally to a large extent and hence are absorbed and accumulate in the body as uric acid. The rational treatment of gout would, therefore, require attention to conditions in the alimentary tract. R. L. STEHLE

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## F—PHYSIOLOGY

ANDREW HUNTER

**The iodine number of urine.** Its relations to the constituents of urine, its variations in different physiological and pathological conditions. LEBULIER. *Arch. med. pharm. milit.* 75, 498-503(1921); *Chem. Zentr.* 1922, IV, 531.—Ten cc. of urine are decompd. with 5 cc. of 5% alc. I and 5 cc. of 10% KI and after 3 hrs. titrated with  $\text{Na}_2\text{S}_2\text{O}_3$ . The difference between the I used and that of a control test with 10 cc. distd.  $\text{H}_2\text{O}$  is calcd. to a 24-hr. basis of urine. No relation was found between the I no. thus detd. and the content of purine bases. For men on a mixed diet (300 g. meat) without muscular work the I no. was 2.79, with muscular work (400 g. meat) 4.58. Directly after eating the I no. increases and also it is higher in patients with bronchial pneumonia, grippe, meningitis, purulent pleurisy, but is less with rheumatism. C. C. DAVIS

**Saliva in nutritive processes: clinical observations in cases of cicatricial atresia of the esophagus.** CHEVALIER JACKSON. *Arch. Pediatrics* 40, 324-6(1923).—From observation on children suffering from total atresia of the esophagus as a result of accidental swallowing of corrosive poisons, these conclusions are drawn: "The saliva plays a much more important part in the nutritive processes of children than is generally realized. It does not seem to make much, if any, difference whether the saliva is mixed with the food in the mouth or in the stomach. Under normal conditions, there is much more saliva conveyed to the stomach between meals or feedings than is mixed and swallowed with the food." JOSEPH S. HEPBURN

**Properties and functions of saliva.** J. H. KAUFFMANN. *Dental Cosmos* 65, 698-701(1923).—A discussion of the chemistry and physiology of the saliva. J. S. H.

**Endocrine glands in relation to dental nutrition and caries.** C. E. DE M. SAJOUS. *Dental Cosmos* 65, 702-13 (1923).—An address with bibliography. In the study of the endocrines, not only the evidence of physiology, but that of all the medical and biol. sciences should be considered. Sections are devoted to the adrenals and their relation to tissue oxidation and heat production, the posterior lobe of the pituitary, the relation of the thyroid, parathyroids and adrenals to metabolism and immunity, and the relation of the endocrines to dental caries.

**Effects of thymectomy.** G. BAGGIO. *Policlin., Sez. Chir.* 30, 197 (1922); *Physiol. Abstracts* 7, 374-3.—Thymectomy tends to decrease the duration of life and the wt. of the thyroid, pituitary, pancreas, ovaries, and testes, while the suprarenals hypertrophy. Thymectomy decreases vagal stimulus and thus causes hyperactivity of the sympathetic. Cf. C. A. 17, 1499.

**Production and destruction of the cholesterol of the spleen during aseptic autolysis.** SALVATORE MARINO. *Atti accad. Lincei* [v] 31, ii, 192-5 (1922).—M. confirms the observation of Abelous and Soula (C. A. 16, 1458) that, during aseptic autolysis of the spleen, the cholesterol content at first increases and subsequently diminishes. The liver and brain show similar behavior, but with the suprarenal and thyroid glands and the kidneys only destruction of the cholesterol occurs. These phenomena are functions of the temp. and time. It thus appears that, more than other organs, the spleen exerts a marked influence on the formation of cholesterol and on the metabolism of fats.

**A biological consideration of the structure and functions of the kidney.** E. SCHWARTZ. *Wiener klin. Wochschr.* 36, 81-4 (1923).—An address contg. interesting speculations on the relation of structure of the tubules to their secretory function.

**The endocrine glands and the digestive apparatus.** GUSTAV SINGER. *Wiener klin. Wochschr.* 36, 273-6 (1923).

**Glucose permeability of the liver.** E. GEIGER AND O. LOEWI. *Arch. ges. Physiol.* (Pflüger's) 198, 633-43 (1923); cf. C. A. 17, 305.—Perfusion expts. on the frog liver showed that Ca slightly inhibits the amt. of glucose given off by the tissue. Na oleate in concns. of 1:50,000 or 1:100,000 was without influence.

**Bile secretion in man: polycholia.** GUNDERMANN. *Beitr. klin. Chir.* (Bruns') 128, 1-17 (1923).—The amt. of bile collected from a biliary fistula in man is always abnormal, bearing no relationship to the physiol. amt. secreted. The NaCl content of the bile is extremely const. and is independent of the salt content of the food. Within the gall bladder both the bile and the NaCl become concd. During starvation the amt. of bile collected from a fistula in man is about 250 cc. and is unrelated to the amt. of urine secreted. Bile secretion is independent of fluid intake. There is a true polycholia of unknown cause and the terms polycholia and pleiochromia should not be used as synonyms.

**Influence of endocrine glands upon susceptibility to convulsions and upon electrical irritability in guinea pigs.** OTTO SPECHT. *Beitr. klin. Chir.* (Bruns') 128, 25-53 (1923).—The extirpation of the thyroid, or of one or both testes, has but little influence upon the susceptibility of guinea pigs to amyl nitrate or to elec. stimulation. With the two operative procedures simultaneously performed and with a simultaneous or subsequent removal of adrenal tissue the sensitivity of the animals is diminished. This reduction in reactivity is probably due in large part to an impairment of the general condition associated with the surgical procedure.

**Changes in bile secretion induced by the ingestion of fluid, preparations of the endocrine glands, and other substances.** OTTO SPECHT. *Beitr. klin. Chir.* (Bruns') 128, 249-83 (1923).—Dogs with biliary fistulas show no significant changes in bile secretion with wide variations in the amt. of food ingested. Meat alone appears to affect the secretion of bile, causing an increase. Fluids injected intravenously or administered *per os* are without effect, although the subcutaneous injection of dextrose diminishes the secretion. The injection of thyroid, hypophysis, or adrenal preps., or of choline does not modify bile production and the simultaneous administration of fluids is without effect. Thymus gland causes a slight diminution, adrenaline a marked reduction, and an ext. of the anterior lobe of the hypophysis a considerable decrease in the amt. of bile. The amt. of urine eliminated is not related to the amt. of bile secreted; the two processes are entirely independent; nor is the sp. gr. of the bile modified by the administration of fluid or glandular products or in any way associated with sp. gr. changes in the urine. The amt. of total solids of bile is relatively const. Treatment with thymus causes a slight decrease, with anterior lobe of the hypophysis a considerable decrease in the total solids. The NaCl content is practically const. under all conditions.

**Saliva in infants.** HEINRICH DAVIDSOHN AND A. HYMANSON. *Z. Kinderheilk.* 35, 10-24(1923).—The  $p_H$  and fermentative activity of the saliva were detd. in 22 children. The saliva of the youngest child examd. (1 month old) showed diastatic action. The  $p_H$  of the saliva was almost const., usually slightly alk. or neutral, and appeared to be independent of the physiol. or pathol. condition of the individual. The concn. in enzyme increases with age; up to the age of 3 mos. normally 1.6 cc. of fluid could be collected in 15 min. with an enzyme value of 475, in older individuals the amt. reached 4.8 cc. with a value of 1200 (starch digestion method of Michaelis and Pechstein). Under normal conditions the variations in the saliva are in amt. rather than in the concn. of enzyme, and in pathol. conditions the amt. secreted is diminished more than in the enzyme concn. Acute nutritional disturbances influence only the amt.; chronic disturbances and severe infections alter both the amt. and the activity. As a rule the diminution in the quantity and the quality parallels the severity of the disease, and frequently an increase can be observed in convalescence. G. H. S.

**Digestion leucocytosis and leucopenia in children.** II. J. C. SCHIFFERS AND CORNELIA DE LANGE. *Z. Kinderheilk.* 35, 95-101(1923); cf. *C. A.* 17, 2136.—In healthy infants and young children the white cell picture is subject to so many disturbing influences that it is impossible to correlate any particular changes with digestion. G. H. S.

**Naturally occurring porphyrins.** O. SCHUMM. *Z. physiol. Chem.* 126, 160-202 (1923).—The porphyrin content of normal urine varies with the amt. of hemoglobin in the diet and appears to be identical with fecal porphyrin. The same substance is present in the urine in tuberculosis and in Pb poisoning. In a case of congenital hematorporphyria the serum contained a pigment spectroscopically the same as the uroporphyrin of H. Fischer (*C. A.* 10, 1671). R. L. STEHLE

**Formation of muconic acid from benzene in the animal organism.** HANNS NEUMAECKER. *Z. physiol. Chem.* 126, 203-9(1923).—Muconic acid could not be detected in the urine of rabbits to which benzene had been administered subcutaneously. R. L. STEHLE

**The nucleic acid of the pancreas.** H. STEUDEL AND S. NAKAGAWA. *Z. physiol. Chem.* 126, 250-6(1923).—The residue left upon the filter in the prepn. of Hammarsten's nucleoprotein was found to contain guanine and adenine in a 1:1 ratio but in very small amts. The corresponding content of nucleic acid would be about 8% of the dry material extd. by alc. and ether. R. L. STEHLE

**Histochemistry of spermatogenesis.** H. STEUDEL AND K. SUZUKI. *Z. physiol. Chem.* 127, 1-13(1923).—Herring testicles were rubbed through a fine sieve and then filtered. The filtrate contained leucine, tyrosine, cystine, tryptophan, lysine, histidine (or histamine), some alanine and creatinine and agmatine. Arginine, valine, serine, proline, glutamic acid, aspartic acid, glycocoll, phenylalanine and pyrimidine bases were not found. R. L. STEHLE

**Pyruvic acid the precursor of acetaldehyde in human blood? An investigation on the occurrence of carboxylase in human blood.** WILHELM STEPP AND BEHREND BEHRENS. *Z. physiol. Chem.* 127, 80-92(1923).—When blood and pyruvic acid are incubated MeCHO is formed, thus indicating the probable presence of carboxylase in the former. R. L. STEHLE

**The proteic acids of the urine.** II. Antoxyproteic acid. S. EDLBACHER. *Z. physiol. Chem.* 127, 186-9(1923); cf. *C. A.* 16, 3490.—The antoxyproteic acid fraction of the urine (the material pptd. with  $(AcO)_2Hg$  in acid soln.) on hydrolysis gives 20% humin-N, 29%  $NH_4$ -N, 13% N pptd. with phosphotungstic acid and 37% monoamino-N. The basic fraction contained 6.6% histidine-N, 3.1% arginine-N and 3% lysine-N. R. L. STEHLE

**Can the animal organism synthesize cholesterol? S. J. THANNHAUSER AND HANS SCHABER. *Z. physiol. Chem.* 127, 278-80(1923).—Incubated hen eggs have a higher cholesterol content than unincubated eggs. The answer, therefore, is in the affirmative. R. L. STEHLE**

ANREP, G. V. AND HARRIS, D. T. **Practical Physiology.** With introduction by E. H. Starling. London: J. and A. Churchill. 212 pp. 10s. 6d. net. Reviewed in *Physiol. Abstracts* 8, 91(1923).

CATHCART, E. P., PATON, D. NOEL AND PEMBREY, M. S. **Practical Physiology.** London: Edward Arnold & Co. 344 pp. Reviewed in *Physiol. Abstracts* 8, 91(1923).

HALLIBURTON, W. D. **Essentials of Chemical Physiology.** 11th Ed. New York: Longmans, Green Co. 343 pp. 8s. 6d. net. Reviewed in *Physiol. Abstracts* 8, 92(1923).

## G—PATHOLOGY

H. GIDEON WELLS

**Investigations of the methods and the clinical value of the gold sol reaction in syphilitic cerebrospinal fluid.** O. GRÜTZ. *Arch. Dermat. u. Syphilis* 139, 426-76; *Chem. Zentr.* 1922, IV, 308-4.—Various methods for the prepn. of Au sols are described. Since grape sugar reduction methods are not thoroughly reliable a formaldehyde reduction method was used. Preliminary tests of the alkalescence of the  $\text{AuCl}_3\text{-K}_2\text{CO}_3$  mixt. with neutral red and litmus indicated that freshly prepd.  $\text{CH}_3\text{O}$  sols. should be used. Clinical expts. showed the usefulness of the Au sol reaction in luetic diseases.

C. C. DAVIS

**The determination of neutral sulfur in urine in the diagnosis of carcinoma.** MARIO ROMANI. *Giorn. clin. med.* 3, 41-6; *Chem. Zentr.* 1922, IV, 478.—The usual method for the detn. of neutral S in urine is modified by allowing the urine to stand 48 hrs. with  $\text{H}_2\text{O}_2$  before boiling and then adding a very small amt. of  $\text{MnO}_2$  as catalyzer of the oxidation. An increased amt. of neutral S (over 10 mg.  $\text{BaSO}_4$  from 100 cc. urine) is more frequently than otherwise found in carcinoma cases and special importance should be attached to this test in early diagnosis.

C. C. DAVIS

**The determination of respiratory metabolism with particular reference to diseases of the thyroid gland.** MARIE KROGH. *Hospitalsvidende* 64, No. 50(1921); *Chem. Zentr.* 1922, IV, 303.—Changes in metabolism not due to fever or diabetes are largely accounted for by diseases of the thyroid gland, including myxedema and Basedow's disease. For clinical measurements of changes in metabolism due to the thyroid gland, the app. of A. Krogh is recommended.

C. C. DAVIS

**A simple method for the identification of pathologic bilirubinemia.** ALFRED VOGL AND BERTHOLD ZINS. *Med. Klinik* 28, 567-8; *Chem. Zentr.* 1922, IV, 925.—Approx. 0.5 cc. of hemoglobin-free serum is pptd. by double the amt. of 20%  $\text{Cl}_2\text{CCO}_2\text{H}$  and the ppt. immediately filtered. If a green color appears after drying (formation of biliverdin) the reaction is a positive sp. one for bile pigment. Comparison of the results with those of the diazo reaction of Bergh leads to doubts whether the positive results obtained with normal serum are due to bilirubin.

C. C. DAVIS

**The determination of the quantity of blood by the optical method. Studies on the amount of blood in a few cases of nephritis.** G. MOSCATI AND G. NAPOLITANO. *Rif. med.* 38, 435-8; *Chem. Zentr.* 1922, IV, 923.—To det. the total amt. of blood, 100 cc. of a 25-50% soln. of dextrose is injected intravenously in place of dextrin (the method of Alderhalden and Schmidt). After 1 min. the diffusion is uniform and after 5 mins. a decrease in the rotatory power begins, which, after deduction of the natural levorotation of the plasma, is a measure of its sugar concn. From this the total amt. of blood can be calcd. by the use of a hematocrit. With the methods given, dogs which had nephritis as a result of injection of 0.01-0.02 g. of uranyl acetate showed a distinct increase in the vol. of blood and especially of the plasma.

C. C. DAVIS

**Analysis of a cystic fluid.** E. MAURIN. *Repert. pharm.* 35, 161(1923).—The following is the compn. of a fluid obtained from a cyst which developed in the scrotal region. The quantities are computed for 1000 cc. of fluid. Dry ext. 12.35 g., ash 10.62 g., albuminoid material 1.62 g. (serin 1.35 g., globulin 0.15 g., nuclealbumin trace, peptones none, pseudomucin none), chlorides (as  $\text{NaCl}$ ) 0.12 g., phosphates (as  $\text{P}_2\text{O}_5$ ) 0.20 g., urea 0.75 g., glucose none, cholesterol trace. Also in *Ann. chim. anal. chim. appl.* 5, 207-8.

A. G. DU MEZ

**Reduction in leucocyte count following the intracutaneous injection of protein-free substances.** HANS RITTER. *Klin. Wochschr.* 2, 784-5(1923).—The intracutaneous injection of a 5% aq. soln. of lactose, olive oil, or fractionated, protein-free, sterilized carrot ext., is promptly and uniformly followed by a reduction in the peripheral leucocyte count. Similar injections given subcutaneously are without effect. This phenomenon must be an expression of some peculiar function of the skin.

MILTON HANKE

**Tuberculin hypersensitiveness and anaphylaxis.** W. DIETRICH AND F. KLOPFSTOCK. *Klin. Wochschr.* 2, 780-1(1923).—A surviving virgin guinea pig uterus from a tuberculous pig, does not contract when treated with tuberculin, but does contract when treated with protein-contg. emulsions of tubercle bacilli.

MILTON HANKE

**Statistical study of tuberculin tests in infancy and early childhood.** S. A. WAHL AND H. J. GERSTENBERGER. *Arch. Pediatrics* 40, 143-50(1923).—A study of the tuberculin tests performed upon 806 patients who were exposed, suspicious, or actively tuberculous. The intracutaneous technic is more sensitive than either the tattoo or the burr procedures. A 1:1000 soln. is the most satisfactory concn. of tuberculin for routine tests.

JOSEPH S. HEPBURN

**Diagnostic value of sugar concentration in spinal fluid.** H. B. WILCOX AND J. D. LYTTLE. *Arch. Pediatrics* 40, 215-25(1923).—A wide and irregular variation between the concn. of dextrose in the blood and in the spinal fluid was noted in an unrelated group of diseases of the central nervous system. In tuberculous meningitis, the dextrose content was low in the spinal fluid and, at times, high in the blood. In epidemic encephalitis, the dextrose content of the spinal fluid was increased. In anterior poliomyelitis, the relation between dextrose concn. in the blood and in the spinal fluid showed no consistent deviation from the normal. Normally, the concn. of dextrose in the spinal fluid is approx. one-half its concn. in the blood.

JOSEPH S. HEPBURN

**Developmental hypoplasia (constitutional inferiority) in children with special reference to endocrine dysfunction.** E. BOSWORTH MCCREADY. *Arch. Pediatrics* 40, 287-305(1923).—Review.

JOSEPH S. HEPBURN

**Recent advances in science—Medicine.** R. M. WILSON. *Science Progress* 17, 585-7(1923).—Review of recent work on insulin.

JOSEPH S. HEPBURN

**Sex specificity of female blood.** E. GRÄFENBERG. *Arch. Gynäkol.* 117, 52-3 (1922).—Exts. of the germinal glands are twice as toxic for animals of the same as for animals of the opposite sex. The same difference in toxicity is shown by antisera obtained with antigens from the germinal glands, antiovarian serum being more toxic for female than for male animals. In the blood of male and female animals differences specific to sex are not demonstrable. On using the red blood cells as an antigen, however, an antiserum is obtained that shows clearly sex specificity, the antiserum from the red blood cells of male animals being twice as toxic for male as for female animals. Analogous relations hold for the antiserum obtained from the red blood cells of female animals. These antisera from the red blood cells behave as if they were made not with red blood cells as antigen but with the help of an ext. from the germinal glands. This indicates a sex-specific reaction in the red blood cells and gives an indication of the reciprocal action of the endocrine function of the germinal glands on the rest of the body.

HARRIET F. HOLMES

**The importance of antithrombin as a neutralizer of the convulsive toxin in the etiology of eclampsia and epilepsy.** DIENST. *Arch. Gynäkol.* 117, 56-67(1922).—Fibrin ferment is found in normal pregnancy in the amniotic fluid and in the placenta but not in the blood plasma. In eclampsia and the nephroses of pregnancy fibrin ferment is found in increased amts. in the amniotic fluid and placenta and also in large amt. in the circulating blood. Antithrombin is present in the liver, ovary and thyroid, and in increased amts. in normal pregnancy. In eclampsia, however, the antithrombin is greatly decreased. It is probable that in normal pregnancy the increased production of antithrombin through heightened activity of the liver and thyroid holds in equilibrium the increased production of fibrin ferment. Renal insufficiency, causing a lessened excretion of thrombin, leads to an accumulation of thrombin in the circulating blood, and with a lessened production of antithrombin to combine with it, eclampsia results from intoxication by fibrin ferment. In epilepsy also thrombin is present in the blood, though in smaller amt. than in eclampsia; antithrombin is present only in traces. In epilepsy also the toxic agent may be thrombin, which accumulates in a toxic dose in the arterial circulation through the insufficient formation of antithrombin.

H. F. H.

**The importance of the functions of the female genital organs in renal diabetes.** HEINZ KÜSTNER. *Arch. Gynäkol.* 117, 158-61(1922).—Glucosuria of renal origin occurs in pregnancy from the earliest weeks until about 4 wks. before childbirth. In using renal diabetes as an indication of early pregnancy it must be remembered that most non-pregnant women show a pre-menstrual glucosuria, which, however, is of short duration. Animal experimentation indicates that the excretion of sugar is a function of the ovaries, perhaps of the corpus luteum, for glucosuria ceases in pregnant animals on removal of the ovaries and is caused in non-pregnant animals by the implantation of ovaries from pregnant animals. Removal of the gravid uterus did not cause the glucosuria to cease.

HARRIET F. HOLMES

**The influence of the hypophysis on the dysfunctioning of the female genital organs.** DIETRICH. *Arch. Gynäkol.* 117, 298-9(1922).—Genital hypofunction in women may be the result of a primary hypofunction of the anterior lobe of the hypophysis. Sugar metabolism tests after the injection of adrenaline in these cases showed an increased carbohydrate tolerance and a lowered hyperglucemia. Administration of anterior lobe hormone caused a decreased carbohydrate tolerance or an increase in hyperglucemia. Adrenaline-sugar tests in pregnant women indicated a hyperfunctioning of the hypophysis in pregnancy, which decreases as pregnancy advances. A hypofunctioning of the hypophysis at the close of pregnancy as shown by the adrenaline-sugar tests leads to the conclusion that the hypophysis plays a role in initiating child birth.

H. F. H.

**The effect of organ extract and light therapy on genital hypofunction and hypoplasia in women.** A. LANDSEKER. *Arch. Gynäkol.* 117, 376-83(1922).—Good clinical results were obtained in the treatment of hypofunctioning and hypoplasia of the genital organs in women by simultaneous radiation by ultra-violet and yellow-red neon rays followed by administration of organ exts., such as luteoglandol, placenta ext. or hormonum femininum. It is probable that the light rays increase the organotropic action of the organ exts. by increasing the production of hormones. HARRIET F. HOLMES

**The internal secretion of the female sexual organs.** C. FELLNER. *Arch. Gynäkol.* 117, 304(1922).—The injection of ovarian or placental lipoids retards the growth of carcinomas implanted in mice. HARRIET F. HOLMES

**Indicanemia and hyperindicanemia in pregnancy.** RÜBSAMEN. *Arch. Gynäkol.* 117, 397-404(1922).—Non-pregnant women show an indican content of 1.67 mg. or less per 1000 cc. blood serum. In normal pregnancy there is a physiol. hyperindicanemia averaging 2.74 mg. Higher values are found in gonorrheal or other infectious processes. With moderate nephritis in pregnancy the indican content averages 4.7 mg. In eclampsia there is a rapid rise in indican at the time of attacks to 60 mg. or more and an equally abrupt fall after the symptoms cease, but even after delivery the indican content remains higher than normal for some time. In nephritis in the pregnant a rise in indican to 7 or 8 mg. precedes uremic manifestations and after delivery the indican content returns to normal only after many weeks. In nephritis high indican values may be obtained, while the urea in the blood is not increased. A sudden increase of indican in nephritis is prognostic of impending uremia and an indication for interrupting pregnancy. HARRIET F. HOLMES

**Protein crystals in the kidney.** KARL REHSTEINER. *Centr. allgem. Path.* 33, 449-55(1923).—Cryst. protein was observed in the tubules of the kidney in frozen sections from a contracted kidney. The crystals were diamond-shaped or rhomboid. The extreme dimensions were 310 $\mu$  in length and 55 $\mu$  in breadth. The material was insol. in water, abs. and dil. alc., warm ether-alc., 25% mineral acids, and fat solvents. It gave the biuret, Millon's and HNO<sub>3</sub> tests for protein. It did not give the I reaction for amyloid. It dissolved on pepsin-HCl treatment. Only 3 other such cases have been recorded. E. R. LONG

**Reappearance of agglutinin which has become latent on the parenteral introduction of deutoalbumose or sodium nucleate.** M. JAGGI. *Z. Immunitäts.* 36, 482-502(1923).—The agglutinin content of rabbit or guinea pig serum, which has fallen or vanished, can be restored by injection of deutoalbumose or Na nucleate. This holds for a variety of bacteria. The antibodies rise slowly on injection of these substances, in a manner comparable to that in an animal immunized for the first time. E. R. LONG

**Complement preservation, especially in hypertonic salt solution.** V. SCIMONE. *Z. Immunitäts.* 36, 443-8(1923).—The activity of guinea pig complement is preserved for a long period in concd. NaCl or NaOAc soln. Tyrode and Ringer soln. in 1:10 diln. preserve complement no better than physiol. NaCl or NaOAc. E. R. LONG

**The action of protein split products in the blood in pregnancy, carcinoma, infectious diseases, etc.** L. REINER AND A. MARTON. *Z. Immunitäts.* 36, 503-17(1923).—High mol. protein decompn. products prepd. from urine (proteic acid and stalagmone by the method of Bechhold) strengthen the formol gelatinization of rabbit serum and increase the power of certain pathol. sera to inhibit hemolysis, increase antitryptic activity, and strengthen the flocculation reaction of Daranyi. They do not confer upon normal serum the properties of pathol. serums. The heaping up of stalagmone may account for the lowering of the surface tension of the serum in pregnancy. Stalagmone solns. cause shock in guinea pigs resembling anaphylactic shock, and delay coagulation of the blood. E. R. LONG

**The chemistry of the Meinicke reaction.** KARL BAUER. *Z. Immunitäts.* 36, 523-30(1923).—The flocculi of the Meinicke reaction are not sol. in urea soln. The flocculi consist of small amts. of lecithin and cephalin physically bound to protein. Neutral fat also is an important constituent. E. R. LONG

**A new serum reaction for the diagnosis of tuberculosis.** LINA BONACORSI. *Z. Immunitäts.* 36, 531-3(1923).—A cholesterolized ext. of tubercle bacilli is added to the serum of tuberculous patients. A ppt. occurred in 92.5% of cases. In 88% the results agreed with the Besredka complement-fixation test. E. R. LONG

**The antigenic power of gelatin.** Y. MARUYAMA AND G. OHSAWA. *J. Formosan Med. Soc.* No. 226(1923); *Japan Med. World* 3, 140.—By repeated injections of 1-2% gelatin a slight increase in immune body production occurred, but it was by no means specific. M. E. MAVER



The cells of the mucous membrane of the digestive tract as toxin or irritant, and their relation to peptic ulcer. Y. MIYAGAWA AND M. TERADA. *Japan Med. World* 3, 123-35(1923).—Rabbits were immunized with the cells of the mucous membrane of the stomach of normal rabbits. The immune serum was injected between the serous membrane and the stomach wall of normal rabbits. Gastric ulcers were formed which were studied microscopically. There were no significant changes in the other organs with the exception of the kidneys. Enterotoxin and hepatotoxin formed in the same way did not cause ulceration of the stomach.

M. E. MAVER

The complement deviation in the Wassermann reaction. JOHN DON. *Kolloid-Z.* 393-4(1923).—A colloid chem. explanation is given of the observations of R. M. Walker (C. A. 11, 2931). It is postulated that the antigen is a colloid and the antibody an emulsoid and that they adsorb the complement.

BENJAMIN S. NEUHAUSEN

Insulin in the treatment of diabetes mellitus. F. G. BANTING, W. R. CAMPBELL, AND A. A. FLETCHER. *J. Metabolic Research* 2, 547-604(1922); cf. C. A. 17, 1502.

Extensive case reports. Interesting suggestions are made as to the criteria by which to judge the requirement of insulin in various cases. Ketosis, acidosis and coma treated by insulin. W. R. CAMPBELL. *Ibid* 605-35.—Two typical cases of successful treatment of diabetic coma with insulin are described. In one case it was administered subcutaneously, while in the second intravenously to obtain more rapid results. Glucose was given simultaneously in order to prevent hypoglycemia and to reduce the combustion of fat to a min. Large amts. of acetone bodies in the blood and urine were reduced to very small values and the initially low CO<sub>2</sub>-combining power of the blood rose to normal values. The advisability of combining alkali (bicarbonate) therapy with insulin in certain cases of coma is discussed. The blood sugar following insulin administration and the symptom complex—hypoglycemia. A. A. FLETCHER AND W. R. CAMPBELL. *Ibid* 637-49.—The fall of the blood sugar following the administration of 20 units of insulin was not uniform in 16 patients tested, whereas the carbohydrate utilization value per unit of any given batch of insulin was quite uniform. It is deduced that the hypoglycemic effect of insulin and its effect on carbohydrate utilization are distinct and sep. phenomena. The symptoms and the treatment of the hypoglycemia are described in detail. The use of adrenaline together with intravenous injections of glucose soln. are recommended for serious cases. Insulin in hospital and home. E. P. JOSLIN, H. GRAY AND H. F. ROOT. *Ibid* 651-99.—A report of 83 cases successfully treated with insulin. Clinical observations on insulin. R. M. WILDER, W. M. BOOTHBY, C. J. BARBORKA, H. D. KITCHEN AND S. F. ADAMS. *Ibid* 701-28.—The method of assaying the potency of insulin by testing its effect on the blood sugar of rabbits was found to be inadequate for clinical use. A clinical method of assay is proposed by means of which the carbohydrate utilization value in diabetic patients is determined. It is found advisable so to regulate dosage of insulin and the diet that the 24-hr. urine specimens show traces of sugar. The hypoglycemic reactions were studied extensively. Metabolic studies showed that insulin does not behave as a calorogenic substance in the human body, that its action can be successfully opposed by epinephrine, and that its probable mode of action on the stable form of the blood sugar is in the nature of a conversion into a labile enolic form, which is more susceptible to oxidation. The behaviors of dextrose and levulose were compared when fed to diabetics with and without simultaneous administration of insulin. The R. Q. (respiratory quotient) rose much more rapidly with levulose alone than with dextrose alone. With the latter an initial depression of the R. Q. was frequently observed. The sp. dynamic effect and the influence on the blood sugar of both of these sugars was approx. the same. When given with insulin glucose produced an initial drop in the R. Q. and then a subsequent rise, while levulose with insulin produced an immediate sharp rise of the R. Q. The blood sugar was elevated less by the levulose than by dextrose. The former is believed to be of greater availability to the diabetic organism than the latter. A clinical study of the effects of insulin in severe diabetes. J. R. WILLIAMS. *Ibid* 729-51.—A report of 44 cases. The effect of insulin on the metabolism in diabetes. R. FIRZ, W. P. MURPHY AND S. B. GRANT. *Ibid* 753-66.—Insulin caused a rise in the R. Q. immediately after administration, and elevated R. Q. was also observed in patients 3 days after the last dose of insulin. The effects on hyperglucemia and ketosis in diabetes observed by the Toronto investigators are confirmed. Importance is attached to the effect of insulin on protein catabolism in diabetics, who under this treatment attain a positive N balance. The use of insulin in juvenile diabetes. H. R. GEYBLIN, G. HARROP, M. F. MURRAY AND E. CORVIN. *Ibid* 767-91.—Strikingly good results are cited. The clinical use of insulin. R. T. WOODYATT. *Ibid* 793-801.—The dangers of hypoglycemic reaction following overdosage with insulin are warned against. The

methods and technic employed in the author's diabetic clinic are described in detail. **Clinical observations with insulin. I. The use of insulin in diabetic treatment.** F. M. ALLEN AND J. W. SHERRILL. *Ibid* 803-985.—Detailed clinical reports of 102 cases treated with insulin are given. The dangers of overnutrition even in conjunction with insulin treatment are emphasized. The authors consistently attempted to keep the blood-sugar level down within normal limits and the urine sugar-free. W. A. P.

**"Blackwater," a disease of metabolism.** G. R. HALL. *J. Trop. Med.* 26, 119-23 (1923).—A discussion of the probable chem. and pathol. factors involved. The role of the protein decompn. products arising in pyrexia and the balance between the body colloids and electrolytes are emphasized. W. A. PERLZWEIG

**Skin injuries by electricity.** STEFAN JELLINEK. *Wiener klin. Wochschr.* 36, 157-8 (1923).—An address. W. A. PERLZWEIG

**The newer turbidity and flocking reactions in syphilis.** K. HAJOS AND ST. HOFHAUSER. *Wiener klin. Wochschr.* 36, 163-4 (1923).—The sera of a number of known luetic and non-luetic patients were tested by the Wassermann, Meinicke, Dold and Kahn reactions. The Wassermann reaction is more sensitive than the Meinicke or Dold reactions, but the latter 2 reactions, because of their lesser sensitivity, appear to be more reliable and more sp. The Dold reaction when used with its formol control is more sp. than the Meinicke reaction. The flocking reactions are not applicable to study of luetic spinal fluids. The const. use of the flocking reactions to corroborate findings with the Wassermann test is recommended. The Kahn syphilis test is judged to be not sufficiently sp. to be reliable. W. A. PERLZWEIG

**Non-protein nitrogen values in diphtheria and the effect of antidiphtheria serum upon them.** GRETE GIESINGER-REISHER AND BERNHARD GIESINGER. *Wiener klin. Wochschr.* 36, 181-3 (1923).—A significant drop in the blood urea content of a number of cases of diphtheria after the administration of antitoxin was observed. The initial concn. of urea in the blood of this case was high, 23-94 mg. %. Complications with persisting fever usually inhibited the drop in the blood urea to some extent. W. A. PERLZWEIG

**The specific and non-specific protein action.** H. V. HAYEK AND L. WIESSER. *Wiener klin. Wochschr.* 36, 183-4 (1923).—A comparative study of skin (scratch) and of the general reactions of tuberculous patients to injections of old tuberculin and of casein soln. While in all of the 10 cases studied 0.01-0.3 mg. of tuberculin protein produced pronounced skin, general and febrile reactions, 500-2000 mg. of the casein was required to produce in the same cases barely perceptible reactions and general symptoms. The use of such quant. differentiation methods between sp. and non-sp. protein reactions is advocated. W. A. PERLZWEIG

**Cholesterolemias.** IRENE BARAT. *Wiener klin. Wochschr.* 36, 221-3 (1923).—The high blood cholesterol figures observed in diseases of the liver, of the kidneys and in diabetes are ascribed to the impaired excretory functions of the liver cells. W. A. PERLZWEIG

**Alimentary asthma.** LUDWIG HOFBAUER. *Wiener klin. Wochschr.* 36, 235-6 (1923).—A discussion of the various probabilities of the absorption of anaphylactogens derived from foods through the intestinal wall is presented. W. A. PERLZWEIG

**The osmotic factor in osmotherapy and in protein therapy.** KARL STEJSKAL. *Wiener klin. Wochschr.* 36, 276-7 (1923).—Far reaching osmotic effects were produced by intracutaneous injections of solns. of electrolytes. The secretion of gastric juice and gastric acidity were greatly increased within 1 hr. upon the injection of 2 cc. of 5% NaCl soln. With protein (horse serum) injections similar but less regular results were obtained. The injection of horse serum into drained hydrocele cavities caused an increased permeability of the blood vessels and of the membranes with a resulting decrease in the non-protein N concn. in the subsequently accumulated fluid. A partial explanation is offered by the osmotic and swelling pressures of the injected protein. Various practical clinical applications of "osmotherapy" are suggested. W. A. P.

**The practical and theoretical significance of the determination of chlorine in the cerebrospinal fluid.** PAUL NEUDA. *Wiener klin. Wochschr.* 36, 447-9 (1923).—The normal Cl value for human cerebrospinal fluid was found to be 0.720% as NaCl. 250 cases of various pathol. conditions were studied. In meningitis uniformly low values were observed, 0.560-0.700%. In the so-called chloruremic conditions high figures were found. The blood Cl content varied in general in the same direction as the Cl concn. of the spinal fluid. Meningitic and brain abscess conditions were rather sharply differentiated by consistently and significantly high figures for the latter. A theoretical discussion of the Cl exchange between spinal fluid and blood in various diseases of the nervous system and of metabolism is included. W. A. PERLZWEIG

Urinary output and blood pressure changes in experimental ascites. J. M. THORINGTON AND C. F. SCHMIDT. *Am. J. Med. Sci.* 165, 880-90(1923).—Complete suppression of urine results when the intra-abdominal pressure reaches 30 mm. Hg. The arterial pressure falls. With smaller pressures the effects are correspondingly less marked. G. H. S.

Formaldehyde gangrene. I. Process of stasis and thrombus formation by formaldehyde in the frog web in vivo. WALTHER JACOB. *Arch. expl. Path. Pharm.* 98, 55-74(1923).—Stasis and thrombus formation are apparently the basis of formaldehyde gangrene as seen in the rabbit ear. The primary cause of the whole circulatory disturbance is damage to the lumen of the vessel walls, especially to the endothelium of the capillaries, and to the corpuscular elements of the blood, in particular the erythrocytes. The damage causes a vasodilation, an increased permeability of the walls, and the exudation of serum into the tissues. The red cells are agglutinated and occlude the capillaries. It may be that the marked effects exerted by the formaldehyde are due to the fact that the mol. in aq. soln. acts as the  $H_2C(OH)_2$  mol. rather than simply as  $H_2CO$ . G. H. S.

Sodium chloride of the bile in diseases of the gall bladder and of the bile ducts. LUDWIG KRÖCK. *Beitr. klin. Chir.* (Bruns') 128, 18-24(1923).—The NaCl content of the bladder bile varies between 0.85 and 0.70%; that of the bile in the common duct from 0.749 to 0.676%. In any individual case the value for the bladder bile is higher than that for the bile in the duct. The NaCl content of the latter is entirely independent of the amt. of NaCl ingested. G. H. S.

JOEL, ERNEST: *Klinisches Kolloidchemie*. Dresden and Leipzig: Verlag von Theodor Steinkopff. 124 pp. 2s. 2d. Reviewed in *Chem. News* 126, 414(1923).

MANN, H. CORRY: *Rickets: The Relative Importance of Environment and Diet as Factors of Causation*. An investigation in London. London: H. M. Stationary Office. 99 pp. 2s. 6d. Reviewed in *J. Am. Med. Assoc.* 81, 238(1923).

PFILER, WILLY, *Die Blutuntersuchungen bei der Rotzkrankheit der Pferde* (Esel, Maulesel und Maultiere). Hannover: M. H. Schaper. 69 pp.

PROFILI, ULDERICO: *Principi di biochimica fisiologica. Immunita, immunizzazione, sieroterapia*. Rome: Soc. tip. A. Manzuzo. 67 pp.

## H—PHARMACOLOGY

ALFRED N. RICHARDS

The sting of bees. FERDINAND FLURY. *Naturwissenschaften* 11, 341-8(1923).—A review of the biological effects with a bibliography. C. C. DAVIS

Phytochemical and pharmacological investigation of the seeds of *Chydenanthus excelsus* Miers. M. DUYSTER. *Pharm. Weekblad* 60, 777-99(1923).—From the seeds of *Chydenanthus excelsus* a cryst. glucoside *chydenanthin* (I),  $C_{27}H_{42}O_{16}$ , was isolated. In a diln. of 1:62000 it hemolyzes defibrinated blood, and in 1:130000 a suspension of red corpuscles. The cholesterol present in the serum retards this action. Dild. 1:20000 it stops the beating of an excised frog heart and 1:400000 a rabbit heart. This effect is not counteracted by atropine or adrenaline. At 1:500 it is fatal to goldfish in 1 $\frac{1}{4}$  hrs. Applied locally to the nostrils it causes violent sneezing and lachrymation. It causes contractions of the excised intestine and uterus, which are only incompletely suppressed by atropine or adrenaline. The fatal dose for rabbits is 15.9 mg. per kg. Treatment of I with  $HNO_3$  gave picric acid and with KOH valeric and oxalic acids. On hydrolysis it yields arabinose, galactose and *chydenanthogenin* (II),  $C_{27}H_{42}O_{14}$ , m. 260°. Treatment of II with AcONa and  $Ac_2O$  gave a *diacetyl deriv.*, m. 252°. *Phenylhydrazone* m. 197°. A. W. DOX

Strychnine poisoning. L. D. HOPPE, JR. *Arch. Pediatrics* 40, 264-5(1923).—A full account of strychnine poisoning in a baby, 20 months of age, who ate "dyspepsia tablets" containing nux vomica. JOSEPH S. HEBURN

Action of mercury. L. J. BOYD. *J. Am. Inst. Homeopathy* 16, 24-9(1923).—A detailed description of the pathological conditions produced by Hg compds. J. S. H.

Effect of drugs on the gastrointestinal tract. A. G. NAST. *J. Am. Inst. Homeopathy* 16, 30-6(1923).—Alc.-free tinctures were permitted to act upon normally contracting segments of rabbit intestine immersed, in oxygenated Tyrode soln. *Arnica montana* produced a slight primary stimulation, followed by a steep depression curve and complete relaxation of the smooth muscle to the stage of atony. *Chelidonium* produced a slight depression followed by strong markedly irregular contractions. *Capsicum* caused relaxation and atony. *Sulfur* exerted a stimulating action; the contractions were more frequent, active and irregular than usual. *Lycopodium* produced

relaxation of the muscle and dilation of the intestine. *Sepia* gave rise to a slight stimulation, followed by an increase in tonicity and number of contractions. J. S. H.

Poisoning of sheep by "Narrawa Burr" (*Solanum cinereum*). SYDNEY DODD. *Agr. Gaz. N. S. Wales* 34, 257-60(1923).—The fruit of *Solanum cinereum* contains a poisonous principle of which the symptoms shown by exptl. animals and the post-mortem findings indicate that the active toxic agent is solanine. If the fruit is eaten fresh and in sufficient quantity, at least 8 ounces, the sol. alkaloid passes directly into the abomasum and death results in a few hrs. In small amts. the fruit does not apparently cause any pronounced illness. Dried fruit does not produce any ill effects unless a relatively large amt. is consumed. The chief symptoms of the poison are salivation, perspiration, intense congestion of the visible mucous membranes, disordered cardiac and respiratory actions, and diarrhea. K. D. JACOB

The dependence of the activity of tryptaflavine and rivanol on alkalinity. L. MICHAELIS AND J. HAYASHI. *Z. Immunitäts.* 36, 518-22(1923).—The disinfecting activity of rivanol, like that of the quinine alkaloids, is dependent upon the reaction, increasing with alkali. The action of tryptaflavine is independent of the reaction. The surface tension of tryptaflavine is little affected by addn. of dil. acid or alkali, while that of rivanol is definitely decreased. E. R. LONG

Pathological changes in the ear after inhalation of illuminating gas. B. HIRAKAWA. *J. South Manchurian Med. Soc.* 11, No. 3(1923); *Japan Med. Soc.* 3, 140.—In 27 guinea pigs there were atrophic changes in the aural nerves and hemorrhages in the internal ear. These changes might be due to a deficiency in the blood O. M. E. MAVER

Comparison of isotonic saline and dextrose solutions. ERICH DÜTTMANN. *Beitr. klin. Chir.* (Bruns') 128, 68-74(1923).—For infusion purposes isotonic dextrose soln. is superior to saline, since it causes a more extended persistence of fluid in the body and thus meets the primary purpose of the treatment; it stimulates metabolism as shown by the abundance of urates and phosphates eliminated through the kidney; and it inhibits the development of acidosis. G. H. S.

Absorption through the cornea. B. NAKAMURA. *Klin. Monatsbl. Augenheilk.* 70, 195-212(1923).—The instillation of hypotonic solns. injures the cornea and the degree of damage parallels the grade of hypotonicity. Test materials (K fluorescein, KI, NaI, and  $K_4Fe(CN)_6$ ) are quickly absorbed from the cornea after it has been treated with a hypotonic NaCl soln.; the degree of absorption and the rate at which the test material appears in the urine is directly related to the tonicity of the NaCl soln. used. Preliminary treatment with hypertonic solns. have less effect upon absorption. The material instilled is eliminated almost entirely by the urine. G. H. S.

Theory of narcosis by inhalation anesthetics. II. Narcosis by indifferent gases under pressure. K. H. MEYER AND HEINR. HOPFF. *Z. physiol. Chem.* 126, 280-98 (1923); cf. *C. A.* 15, 2924; 16, 2553.—Previously obtained data were extended by the employment of  $CH_4$  (5 atm.) and N (100 atm.) employing mice, frogs and salamanders. Narcosis resulted when the concn. of the gas in the body lipid was about 0.06 mol. per l. The narcosis produced by  $C_2H_4$ ,  $C_2H_2$  and  $CS_2$  is also reached when the concn. is about 0.06 mol per l. R. L. STREHLE

The action of acetylene. II. The solubility of acetylene in water and blood. R. SCHOEN. *Z. physiol. Chem.* 127, 243-59(1923).—A method is described in detail for detg.  $C_2H_2$  in  $H_2O$  and in blood at different temps. and pressures. The soly. in blood follows Henry's law and is not influenced by the presence of O. R. L. STREHLE

Review of the organic mercury compounds (JÜRGENS) 10.

INGHILLERI-PALERMO, G: *Costituzione chimica e azione fisiologica*. Turin Tip. sociale torinese. 157 pp.

POLAK, J. B: *Chinine en chinidine by hartziekten in het bijzonder by de geheel onregelmatige hartswerking*. Met een chemisch gedeelte van L. van Itallie. Leiden: A. W. Sijthoff. 47 pp.

## I—ZOOLOGY

R. A. GORTNER

Chemical study of several marine mollusks of the Pacific coast. The reproductive system. P. G. ALBRECHT. *J. Biol. Chem.* 56, 483-7(1923); cf. *C. A.* 15, 1357-8.—The reproductive systems of the abalone, Pismo clam, *Cryptochiton* and *Ischnochiton* were collected during the breeding season and analyzed. Large amts. of lipoids were found. Glycogen was absent. Large amts. of reducing sugars were obtained upon hydrolysis of both the  $EtOH$ -sol. and  $EtOH$ -insol. fractions. Urea was found only in the *Cryptochiton* and *Ischnochiton*; its absence from the others probably was due to the urease

they contained. The 4 forms mentioned and the owl limpet all contained amylase, glycogenase and maltase; emulsin was found in the Pismo clam and *Cryptochiton* and lipase and urease in the abalone, Pismo clam and limpet.

I. GREENWALD

**Studies on internal secretion. I. Effect of pituitary (anterior lobe) injection upon normal and thyroidectomized axolotls.** LANCELOT HOGGEN. *Proc. Roy. Soc. London* 94B, 204-15(1923).—Pituitary feeding had no influence on the metamorphosis of medium-sized or sexually mature axolotl larvae of *Amblystoma tigrinum*. Injection of ext. of its anterior lobe into larvae of the same ages and dimensions caused assumption of the adult characteristics with a rapidity comparable to the metamorphosis produced by administration of thyroid; this assumption began 2 to 3 weeks after the first injection. Evidence was also obtained of the efficacy of anterior lobe ext. to induce metamorphosis in thyroidectomized larvae. Successful transplantation of the thyroid from a large sexually mature axolotl into a medium-sized individual did not produce metamorphic changes.

JOSEPH S. HEPBURN

**Metabolic gradient of frog egg.** H. G. CANNON. *Proc. Roy. Soc. London* 94B, 232-49(1923).—With early embryos of *Rana temporaria*, the course of disintegration produced by lethal concns. of external agents showed no regularity. These embryos were more susceptible to strong than to weak solns. of  $\text{HgCl}_2$ , the reverse was true for solns. of KCN. Early embryos of *Bufo vulgaris* were more susceptible to strong than to weak solns. of KCN. The effect of solns. of KCN and  $\text{HCHO}$  on the cleavage ratios of the early embryos of both species was probably due to a direct action of the toxic soln. on the yolk as well as to its general inhibitory effect on the metabolism.

JOSEPH S. HEPBURN

**Studies in amphibian color change.** H. R. HEWER. *Proc. Roy. Soc. London* 95B, 31-41(1923).—Frogs were exposed to the action of certain gases ( $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{H}_2$ ) for a period of 3 hrs., and the resulting color change (if any) noted.  $\text{H}_2$  had no effect; absolutely pure  $\text{N}_2$  produced a certain amt. of dispersion, but was toxic within 1.5 to 2.0 hrs.;  $\text{O}_2$  produced concn. in the melanophores. Frogs were also exposed to the action of  $\text{CO}_2$ , which proved toxic within 15 min. even when mixed with considerable  $\text{O}_2$ ; the  $\text{CO}_2$  did not affect the color before proving toxic.

JOSEPH S. HEPBURN

**Time relations in amphibian metamorphosis with some general considerations.** JULIAN HUXLEY. *Science Progress* 17, 606-18(1923).—Review with special reference to the action of the endocrines.

JOSEPH S. HEPBURN

**The mechanism of sterilization of the female by spermatotoxin.** J. L. MCCARTNEY. *Am. J. Physiol.* 63, 207-17(1923).—Female rats may be sterilized for a period of 2 to 22 weeks by subcutaneous injections of spermatozoa or testes ext., but not by exts. of other organs. Sterility appears to be due to the presence of spermatotoxin in the vaginal and uterine secretions, which immobilize and agglutinate the spermatozoa. Immunization with spermatozoa does not affect the sexual cycle of the female. Subcutaneous injection of spermatozoa into male rats tends to cause destruction of the spermatozoa and atrophy of the testes. The subcutaneous injection of rooster sperm into laying hens, does not influence the rate of egg production, but renders the eggs infertile for a period of from 12 to 67 days.

J. F. LYMAN

**Resistance of fish to salts and alkalinity.** R. T. YOUNG. *Am. J. Physiol.* 63, 373-88(1923).—The effect of several salts at different alkalinities were tried on a number of species of fresh-water fish. It is concluded that the lethal action of most alk. waters is a composite one, and not due to a single action of any particular salt, since the concn. of any salt in natural waters seldom equals the lethal concn. of such salts in the expts. There was considerable variation among the different species of fish in resistance to alk. The conclusions of Wells (*C. A.* 10, 1381) in regard to the effect of alk. on fish are too far-reaching. Osmosis is the most important factor detg. the suitability of water for fish. Any water with an osmotic pressure greater than 6 atms. is of doubtful suitability for the introduction of fish.

J. F. LYMAN

**The absence of lipolytic enzymes in the intestinal juice of the silk worm.** CAMILLO ACQUA. *Ann. scuola agr. Portici* (2) 13, 1-8(1920).—To obtain intestinal juice from a particular section the larvae were disemboweled and the section of the intestine desired was used. The customary procedure for obtaining enteric juice was to induce vomiting by slight etherization with petroleum ether; the larvae recovered promptly to complete their normal life cycle. This procedure insured the absence of admixed blood due to lacerations of the intestinal wall by vomiting due to more violent means. The passage of starch through the intestines without alteration indicates the absence of saccharifying enzymes. An invertase was shown to be present in the juice. The lack of action on oil of almond and on the fat extd. from mulberry leaves showed the absence of a lipase.

ALBERT R. MERR

**Osmotic properties of the eggs of *Sabellaria alveolata*.** E. FAURÉ-FREMIET. *Compt. rend. soc. biol.* 88, 1028-31 (1923).—The egg cytoplasm of *Sabellaria* is impermeable to sucrose, permeable to urea, and is relatively permeable to Cl; the permeability to Cl apparently depends upon the effect of the cation on surface tension. Within the limits of mol. and ionic concn. of 0.8-1.9 per l. the imbibition of water is strictly governed by the conditions of osmotic equil. Within the limits of concn. of 0.85-1.48 where the amt. of imbibed H<sub>2</sub>O varies from 2.9 to 1.55 per g. of dry substance normal development is possible. When the imbibition becomes greater the rate of development tends to approach zero.

S. MORGULIS

**Oxidases in the formation of bands in snail shells.** M. A. VAN HERWERDEN. *Biol. Zentr.* 43, 129-31 (1923).—The presence of oxidases in the colorless bands of the shell of *Limnea ovata* was demonstrated by treatment with Röhman and Spitzer's reagent,  $\alpha$ -naphthol and dimethylparaphenylenediamine, whereupon the bands were colored a distinct blue. The color may be fixed by the addn. of KI. On immersion of the shell into glycerol the blue striation is seen to consist of closely packed dark blue granules.

W. A. PERLZWEIG

**The origin of pigmentation of birds' eggs.** H. GIERSEBERG. *Biol. Zentr.* 43, 167-8 (1923); cf. *C. A.* 16, 3977.—The possibility of the formation of the pigment in the lumen of the oviduct is discussed. The chem. origin of pigment is not elucidated. W. A. P.

**Pigment changes in *Hyperia galba*.** CONRAD LEHMANN. *Biol. Zentr.* 43, 173-5 (1923).

W. A. P.

**Growth of caterpillars.** E. ABDERHALDEN. *Z. physiol. Chem.* 127, 93-8 (1923).—Efforts to influence the growth of butterfly caterpillars by spraying the plants fed upon with amino acids did not yield any significant results. Wt. curves and H<sub>2</sub>O and N contents at different ages are given.

R. L. STEHLE

**The composition of herring roe.** I. ICHTHULIN, H. STEUDEL and E. TAKAHASHI. *Z. physiol. Chem.* 127, 210-9 (1923).—The nitrogenous material extractable with NaCl soln. and dil. alkali when analyzed by the method of Kossel and Kutscher gives N percentages as follows: humin-N (I) 6.8, NH<sub>2</sub>-N 1.8, humin-N (II) 1.7, histidine-N 2.5, arginine-N 14.5, lysine-N 10.1, N not pptd. by phosphotungstic acid 61.8. It gave no reduction after treatment with HCl. II. **The egg shells.** H. STEUDEL and S. OTATA. *Ibid* 220-3.—The shells, which remained insol. in the above extrn. process, showed the following percentages of N: humin-N (I) 5.4, humin-N (II) 1.9, NH<sub>2</sub>-N 2.05, histidine-N 4.0, arginine-N 14.4, lysine-N 7.5, N not pptd. by phosphotungstic acid 62.1. After acid hydrolysis the substance does not reduce. Only 0.5% of S is present.

R. L. STEHLE

## 12—FOODS

W. D. BIGELOW AND A. E. STEVENSON

**Inactive malic acid as a food acidulant.** J. M. WEISS, C. R. DOWNS and H. P. CORSON. *Ind. Eng. Chem.* 15, 628-30 (1923).—As a result of the manuf. of synthetic malic acid under the authors' patents and its subsequent conversion to malic acid, a new outlet for the material was sought. The toxicity of malic acid to rabbits was detd., as well as other properties which might affect its use as a food acidulant. It may be safely used to replace the natural fruit acids now employed. Malic, citric and tartaric acids showed no cumulative effects and in every way their actions are the same.

L. W. RIGGS

**Determination of acids in acid food.** E. CRASEMANN. *Chem.-Ztg.* 47, 134-5 (1923); cf. Wiegner and Magasanik, *C. A.* 14, 1947.—The acid food (100 g.) is placed in a flask and made up to 1 l. with H<sub>2</sub>O and allowed to stand 12 hrs., 1 cc. of 37% HCHO being added to prevent fermentation. The liquid is then filtered, titrated for total acidity, a portion is distd. off and the undistd. portion again titrated for acidity. The volatile acids are estd. in the original ext. on the principle that in steam distn. of dil. solns. the ratio of the acid vapor passing over to the water vapor is const., which may be expressed as a logarithmic function by the formula  $k = (\log y_1 - \log y_2) / (\log x_1 - \log x_2)$ , in which  $y_1$  and  $y_2$  represent amts. of acid at the beginning and end of the distn., resp., and  $x_1$  and  $x_2$  the amts. of water at the beginning and end of the distn., resp.  $k$  is characteristic for each acid; it equals 0.66 for AcOH and 1.91 for butyric acid. The use of this formula is illustrated by examples. Combined volatile acids are set free by the addn. of 10 to 20 cc. N H<sub>2</sub>SO<sub>4</sub> or H<sub>3</sub>PO<sub>4</sub>. Free non-volatile acids are estd. by difference. Dark colored exts. are dild. with CO<sub>2</sub>-free water and titrated with 0.05 N NaOH with phenolphthalein indicator. Cf. following abstract. L. W. RIGGS

**Estimation of volatile fat acids in alcohol-containing liquids by aid of the Wiegner distillation equation.** MAX KLEIBER. *Mitt. Lebensm. Hyg.* 14, No. 3, 131-42(1923); cf. preceding abstract.—By boiling off alc. from a mixt. of alc. and water ( $\log a_1 - \log a_2$ )/( $\log w_1 - \log w_2$ ) = 12.9 in which  $a_1$  and  $a_2$  denote the amt. of alc. in the distg. flask at the beginning and end, resp., of the boiling and  $w_1$  and  $w_2$  denote the corresponding amts. of water. For dil. mixts. of AcOH and H<sub>2</sub>O the factor is 0.657. For dil. mixts. of alc. and AcOH the factor is 12.9/0.657 = 19.6. The variation of the ratio, residue to distillate, according to the alc. content, is worked out. Examples show the method of applying mathematical formulas to exptl. results. An increase in the alc. content of dil. AcOH decreases the percentage of AcOH in the distillate when  $1/3$  is distd. over. A method for the estn. of alc. and AcOH in wine and similar liquids is worked out and compared with a method by distn. in a current of steam. L. W. RIGGS

**Removal of bitter and poisonous substances from lupine seeds used for food.** ERNST BECKMANN. *Chem.-Ztg.* 47, 301(1923); cf. C. A. 16, 1284, 3743; Mach and Lederle, C. A. 16, 2159; Gerlach and Luecke, C. A. 16, 3979.—A new method by Bergell and Boll, (Ger. pat. 363,545) is discussed. By this method ground lupine seeds are treated with water at room temp. with access of air. This treatment does not remove the bitter taste or the alkaloids. L. W. RIGGS

**Determination of albumin in dried egg mixtures.** W. S. ARNOLD. *Maryland Acad. Sci. Bull.* 3, No. 1, 9-10(1923).—About the only substance const. in eggs and relatively permanent in the dried product is albumin. If the protein ( $N \times 6.25$ ) in the whole egg is 50.5%, in the white 89.0, and in the yolk 31.5, it follows that for every 1% increase in the amt. of albumin in a mixt. of albumin and yolk, there is an increase of 0.575% in the protein. All values are on the water-free basis. From the above figures it is calcd. that the albumin solids constitute 33% of the whole egg solids. The albumin solids,  $A$ , in any sample of dried egg will be  $A = (50.5 - P)/0.575$ , where  $P$  = protein ( $N \times 6.25$ ) on a water-free basis; and the amt. of com. albumin in the mixt.,  $A''$ , or "albumin equiv." is  $A'' = (A \times 100)/TS$ , where  $TS$  equals the total solids. In mixts. of whole egg and yolk the whole egg  $WE = (A \times 100)/33$ , and the yolk added or excess yolk  $Y = 100 - WE$ . These formulas were tested on 10 mixts. of com. dried yolks and albumins. But 2 detns. were necessary, moisture and protein, both best made by A.O.A.C. methods. L. W. RIGGS

**March of hydrogen-ion concentration in bread doughs.** C. H. BAILLY AND R. C. SHERWOOD. *Ind. Eng. Chem.* 15, No. 6, 624-7(1923).—It is evident from the data accumulated that the H-ion concn. increases at a fairly uniform rate in bread doughs fermented under fixed conditions. In terms of  $p_H$  this increase appears graphically as an approx. straight line, within the time limits studied. In a 4-hr. period the change in  $p_H$  of lab. straight doughs averages about 0.41 unit, and in com. straight doughs about 0.47 unit. Increasing the temp. of the dough as in the "proof" when the dough is finally molded into loaves and raised in the pan, accelerates the rate of increase in H-ion concn. In straight-dough batches weighing about 1000 lbs. the rate of change in  $p_H$  is apparently somewhat more rapid than in the 1 lb. lab. batches. H<sub>2</sub>PO<sub>4</sub> or acid phosphates added to doughs increase the H-ion concn., which remains at a higher level throughout the fermentation period. Sponge doughs made with more than the proportion of water usual for straight doughs, increase in H-ion concn. at a somewhat more rapid rate than do the straight doughs. The change in  $p_H$  is more rapid in high-grade or patent-flour doughs than in low-grade or clear-flour doughs. The exact chem. character of the acid material which accumulates in dough during fermentation has not been established. Probably org. acids are chief in this group of materials and these result from acid-producing bacteria usually present in the dough ingredients. That certain of these acids are volatile is suggested by the reduction of H-ion concn. during baking. L. W. RIGGS

**Soft oily bacon—its cause and prevention.** F. M. JACKSON. *J. Ministry Agr.* 39, 261-7(1923).—Soft pork fat appears to be the result of a form of malnutrition from a diet over-rich in fat. The relative softening power for the production of soft pork fat based on their chem. properties for various commercial fats is as follows: linseed, soy-bean, maize, beechnut, cottonseed, wheat, oat, rice, peanut, barley, rye and bean. The softening power of linseed oil (*i. e.*, the greater the softening power of an oil, the more pig fat will be softened by a given wt. of it) is greatest and that of bean least. On this basis the relative capacity of various feeding stuffs for the production of soft pork is calcd. and tabulated. H. B. LEWIS

**Suitability of various solvents for extracting vanilla beans.** I. J. B. WILSON AND J. W. SALB. *Ind. Eng. Chem.* 15, 782-4(1923).—Because of the restrictions on the use of alc. which have followed prohibition, and the consequent substitution of other

solvents for extn. of flavors, some preliminary work has been done to det. whether or not these alc. substitutes produce the same amt. and kind of exts. as those prepd. from Et alc. This investigation was limited to several varieties of vanilla and the tonka beans; the solvents selected were isopropyl alc., ether, acetone, and  $\text{CCl}_4$ , to be compared with Et alc. The alc. solvents are much superior from the standpoint of quantity of extn., the  $\text{CCl}_4$  being the poorest in this respect. It is possible, however, that a preliminary extn. with ether or  $\text{CCl}_4$  followed by a weak alc. soln. may be found practicable. Work on the analysis of the final exts. is still in progress.

J. A. KENNEDY

**Jellying of sorghum sirup.** Effect of malt diastase upon the filtration of sorghum juice. S. F. SHERWOOD. *Ind. Eng. Chem.* 15, 780-2(1923).—Starch seems to be largely responsible for the jellying of sorghum sirup and for the extreme difficulty in filtering sorghum juice, especially after it has been heated. Preliminary treatment of the juice with malt diastase greatly increases the rate of filtration and prevents the "jellying" of the finished sirup.

J. A. KENNEDY

**The relation of alcohol precipitate to jellying power of citrus pectin extracts.** RUTH JOHNSTON AND MINNA C. DENTON. *Ind. Eng. Chem.* 15, 778-80(1923).—The amt. of alc. ppt. is not a reliable measure of effective pectin, as shown by comparisons of pectin solns. prepd. in the open kettles and in an autoclave. Dets. based upon jellying power give the only satisfactory means of estg. effective pectin content at present known. Citrus pectin exts. prepd. in an autoclave at 5 lbs. pressure for 30 min. had 25% less jellying power than similar exts. prepd. in the open kettle. The addition of acid in open-kettle exts. of orange peel produced an ext. of about 100% greater jellying power than when no acid was used.

J. A. KENNEDY

**The development of honey analysis.** GEORG BORRIES. *Z. angew. Chem.* 36, 352-3(1923).—Following the (German) food law of May 14, 1879, an impetus was given to the study and practice of food analysis. The contributions of Beckmann, Hilger, Barschall, Fiehe, Stegmüller and Keiser to the study of admixed dextrose and invert sugar, of Behre on the detn. of the individual sugars present, of Auzinger on the diastatic ferments in pure honey, of Bruhns, Borries, *et al.* on total solids, are reviewed.

W. C. EBAUGH

**Multitotation of honeys.** P. BALAVOINE. *Mitt. Lebensm. Hyg.* 14, No. 3, 125-31 (1923).—The rotatory power of 13 samples of honey before and after being subjected to the action of different clarifiants, heat and chemicals, was detd. with 20% solns. in 200-mm. tubes. Boiling even for 5 min. does not instantly terminate multitotation nor does it entirely cease 3 hrs. after cooling. The addn. of  $\text{NH}_3$  or  $\text{Na}_2\text{CO}_3$  produces a more rapid effect than boiling, but in some tests multitotation had not ceased 3 hrs. after cooling.  $\text{Pb}(\text{AcO})_2$  as a clarifiant hastened the course of multitotation as compared with kieselguhr. It appears to require 24 hrs. after cooling to attain a const. rotatory figure. Certain brown dextrogyrous honeys continue to exhibit multitotation for many days after their soln. This occurs only with honeys clarified by kieselguhr or by  $\text{Al}(\text{OH})_3$ . The addn. of  $\text{Pb}(\text{AcO})_2$  arrests this development. The reasons for this behavior appear somewhat obscure.

L. W. RIGGS

**Colors of natural and of artificial honeys.** P. DUMARTHÉRAY. *Mitt. Lebensm. Hyg.* 14, No. 3, 145-6(1923).—Examn. of 14 natural and 4 artificial samples of honey, by testing their coloring power on wool, proved that the natural honey contained a substance capable of coloring wool, and that the intensity of the color was increased by using tartaric acid as a mordant. Therefore, it does not follow that a honey is artificial because it colors wool. If the wool colored by honey is changed by acid or by alkali it is probable that artificial coloring has been added.

L. W. RIGGS

**The removal of an undesirable flavor and aroma from honey.** W. A. GOODACRE. *Agr. Gaz. N. S. Wales* 34, 379-80(1923).—Certain undesirable flavors and aromas occasionally found in honey may be completely removed by treating with coarse-grained animal charcoal, 30 ounces to 50 lbs. of warm honey, for 12 hrs. Alumina cream, 1 ounce to 1 lb. of honey, will remove the undesirable constituents in 30 min. but filtration of the mixt. is difficult.

K. D. JACOB

**Simple milk formulas.** D. W. HORN. *Science* 57, 748-9(1923).—Attention is called to two rules recommended as guides in sorting out samples of herd milk that are above suspicion of skimming or watering: Rule I. Add 3 to the lactometer reading and then divide by 10. The result is the minimum % fat to be expected in that milk if it is above suspicion of skimming. Rule II. When lactometer readings from 26 to 30 are arranged in ascending order, the corresponding minimum percentages of fat in herd milks above suspicion of watering are whole numbers arranged in descending order from 6 to 2. The derivation of these rules from Fleischmann's, Babcock's and Bialon's formulas is shown.

O. L. EVERSON



**Amyl alcohol for milk testing.** T. F. HARVEY AND C. O. HARVEY. *Analyst* **48**, 213(1923).—The directions for testing amyl alc. for oily impurities, as given by the Inst. of Chem. and Soc. of Public Analysts, state that 2 cc. with 10 cc. of water and 10 cc. of  $H_2SO_4$  should not show any oily layer after it is centrifuged in a graduated Gerber milk tube for several min. If these directions are followed, perfectly good samples of amyl alc. may show the oily layer. This misleading result may be avoided by mixing the acid and water, cooling, and then adding the amyl alc.

**Rapid method for determining the approximate bacterial number in milk by using methyl orange.** M. SAITO. *J. Sci. Agr. Soc. (Japan)* No. 242, 929-45(1922).—The principle is based on the fact that the reducing power of milk is proportional to the no. of bacteria. To each 10 cc. milk, 0.0001 g. of methyl orange is added and the time required for complete reduction of the dye is detd. If the no. of bacteria is plotted as abscissa and the reduction time (in hrs.) is plotted as ordinate, the curve is roughly antilogarithmic. The relationship between reduction time and bacteria no. holds for different kinds of milk. A milk contg. over 1 million bacteria reduces the dye within 4 hrs. The reduction time has no relationship to the acidity of the milk.  $40^\circ$  is the optimum temp.; at  $50-60^\circ$  the reaction is slowed up; at  $70^\circ$  the reduction is very meager and at  $90^\circ$  it ceases. The reduction of the methyl orange by the bacteria is slower than that of methylene blue; its end point is sharper and it is free from the effect of atm. O.

**The relations of aqueous cane-sugar solutions and fat-free milk.** F. REISS. *Forsch. Geb. Milchwirtsch. Molkeereives* **2**, 116-8; *Chem. Zentr.* **1922**, IV, 68-9.—According to Clausnitzer and Mayer (cf. *Forsch. Geb. Viehhaltung* **1879**, 265) the coeff. 0.00375 (by which each % increase in fat-free dry substance increases the d. of milk) agrees closely with the corresponding coeff. 0.0039 for raw sugar solns. The influence of the albumin and ash constituents must, therefore, be similar to that of sugar. Accordingly it should be possible to read from sugar tables the fat-free dry substances in milk without notable differences in the analytical results and those calcd. by the Fleischmann formula. According to C. and M. (*loc. cit.*) the d. of milk increases approx. 0.001 per 1% fat removed. If from this the d. of fat-free milk is calcd. by subtracting the content of dry substance from the Windisch sugar tables, it is found that these values agree well with the analytical values and with those calcd. by the Fleischmann formula. Several examples are given.

**Analysis of margarine.** G. D. ELDON. *Chem. Age* **8**, 450-2(1923).—This study considers the different oils and fats which are used in the manuf. of margarine. From the usual phys. and chem. data, including the Polenske and Kirschner numbers, empirical formulas are devised for calcg. the percentage of coconut oil and of butter fat. A table gives the compn. of 8 mixts. of fat prepd. in the lab., each mixt. contg. 3-5 fats selected from butter fat, oleo, premier jus, coconut oil, ground-nut oil, palm-kernel oil, cottonseed oil, lard, and hardened whale oil. A second table gives the analytical figures of the following tests which were observed for these mixts.: Reichert-Meisss, Polenske, Kirschner, total Blichfeldt, sol. Blichfeldt, insol. Blichfeldt, saponification, iodine, refractive index, m. p., Halphen test, Belfield test—beef, Belfield test—lard, and nickel test. Since vitamin fat-sol. A is entirely absent from lard, vegetable oils, and hydrogenated oils, all margarine should contain a reasonable amt. of beef fat or butter.

**Metallic flavor in dairy products with special reference to butter.** G. L. A. RUEHLE. *Abstracts Bact.* **5**, 23(1921).—Cream was treated with either Fe lactate or Cu lactate in the ratio of 200 parts lactate per 1000, then was used for the manuf. of butter. The fresh butter had a metallic flavor. During cold storage the butter contg. Cu developed tallowiness and a fishy flavor, while that contg. Fe developed indefinite, off flavors. Metallic flavor was developed by 2 strains of *B. subtilis* and by the following members of its group: *B. mycoides*, *B. megatherium*, *B. mesentericus vulgatus*, *B. ramosus*. The rapidity of development of the flavor was apparently correlated with the ability of the microorganism to produce peptonization of litmus milk at a temp. of  $37^\circ$ . J. S. H.

**The chemistry of the ripening of cheese.** I. The degradation of protein during the ripening of Tilsit cheese. W. GRIMMER. *Forsch. Geb. Milchwirtsch. Molkeereives* **2**, 119-23; *Chem. Zentr.* **1922**, IV, 264.—A quant. investigation of the distribution of N in fractions pptd. individually from a soln., including the total N,  $H_2O$ -sol. N, N pptd. from its  $H_2O$  soln. by HOAc, N pptd. by  $Pb(OAc)_2$  from the filtrate of the HOAc pptn., N pptd. by phosphotungstic acid (hexone bases and amines) after removal of high mol. substances, N in amino acids and N in  $NH_3$ . The progress of ripening was characterized by a continuous increase in  $H_2O$ -sol. N for 4 mos. With cheeses rich in fat, ripening (as a function of the increase in  $H_2O$ -sol. N) continued for 5 mos. After continuous

ripening for 4 or 5 mos. no further increase in dissolved N-contg. substances occurred. But ripening actually continued, for a distinct decrease in high mol. N compds. pptd. by Pb salts or tannic acid occurred, with increase in amino and diamino acids of low mol. wt. (formation of amino N at the expense of peptone N). Ripening is therefore a function of time and is a very slow process. C. C. DAVIS

**Microbiological investigation of sweet clover silage.** DAN H. JONES AND J. GIBBARD. *Sci. Proc. Am. Soc. Bacteriologists* 1922; *Abstracts Bact.* 7, 20-1(1923).—"In silage made from sweet clover before it is mature, that is well and tightly packed in the silo to exclude air, the conditions prevailing induce a fermentation apparently due mainly to certain acid-forming bacteria, accompanied by a rise in temp. and inhibition of the growth of putrefactive bacteria, yeasts and molds." The av. values of the  $p_H$  of the silage were: before ensiling 6.7, 7th day from ensiling 4.9, 14th day 4.6; the highest acidity ( $p_H$  4.4) was obtained, in some cases, at a later period of storage.

**Report on sulfur and phosphorus in the seeds of plants.** W. L. LATSHAW. *J. Assoc. Official Agr. Chem.* 6, 414-8(1923).—Collaborative work was done on the detn. of S in certain feeding stuffs by the bomb method, the  $Mg(NO_3)_2$  method and the official method. All 3 methods gave satisfactory results. The  $Mg(NO_3)_2$  method is easiest of manipulation and requires the least amt. of expensive app. It is recommended that this be substituted for the present official method. M. S. ANDERSON

Flora of corn meal (THOM, LE FEVRE) 11C.

BERG, RAGNAR: *Die Nahrungs- und Genussmittel, ihre Zusammensetzung und ihr Einfluss auf die Gesundheit, mit bes. Berücks. d. Aschenbestandteile.* 2nd revised ed. Dresden: E. Pahl. 67 pp.

FIELDING, CHARLES: *Food.* London: Hurst & B. 370 pp. 12s. 6d.

LANG, VICTOR: *Die Fabrikation der Kunstbutter (Margarine) Kunstseisefette und Pflanzenbutter.* 5th revised ed. Vienna and Leipzig: Hartleben. 160 pp.

**Sterilizing cheese.** E. E. ELDRIDGE. U. S. reissue 15,648, July 10. See original pat. No. 1,374,141, C. A. 15, 1952.

**Evaporative condensation of milk or other liquids.** C. E. ROGERS. U. S. 1,461,164, July 10. Milk or other liquid undergoing evapn. is repeatedly sprayed upwardly from a body of the liquid in an evapn. chamber and the spray is subjected to a cooling and desiccating air current. In the evapn. of milk the main body of liquid may be maintained at a temp. of about 60° or slightly higher.

**Steam-jet emulsifier.** G. GRINDROD. U. S. 1,461,653, July 10. The app. is adapted for emulsifying fatty substances with milk constituents.

**Yeast extracts.** M. L. MARSAU (née PORTESSEAU). Brit. 190,147, Dec. 6, 1922. Imitation meat ext. and powders are made from yeast. The yeast is washed and filtered, solvents for hop resins, etc., such as  $NH_4CO_3$ , and disinfectant being added if required. It is then digested with  $H_2O$  at temps. either so high or so low as to check fermentation. The liquid is filtered off and concd. Salt, aromatic substances, and gelatin may be added. The residue is broken up in boiling water, dried, ground and sifted to form an imitation meat powder.

### 13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

**Satisfactory operating conditions during 1922.** ANON. *Chem. Trade J.* 73, 3-5 (1923).—Abstract from the Alkali Inspector's Rept. Observations in England and Scotland of heavy chem., cement, smelting, and tar works as regards the emission of objectionable and noxious gases. Complaints have developed against unregistered works rather than registered works. Improvements noted are: use of the rotating grate in cement manuf., use of high-pressure water sprays instead of shower and drip method in fertilizer works. At one coke-oven F is found as a regular constituent of the gas liquor. W. H. BOYNTON

**Industrial outlook for colloid chemistry.** H. N. HOLMES. *Ind. Eng. Chem.* 15, 856-8(1923).—A review of some of the possible colloid developments of the future, under the following heads: Plauson's colloid mill; adsorbent gels; sulfite waste pulps;

syneresis; smoke settling; emulsions; wetting power; lubrication; carbon black and lamp black; glass and enamels; paper and paints.

JEROME ALEXANDER

**Comparison of gas masks, hose masks, and oxygen-breathing apparatus.**

S. H. KATZ AND J. J. BOURQUIN. *Bur. Mines, Repts. Investigations* No. 2489, 5 pp. (1923).—Gas masks are simplest but protect only in low concns. of noxious gases and should not be used in air contg. less than 16% O. Hose masks protect anywhere but are cumbersome, and serviceable only within the length of the hose attachment. Self-contained O-breathing app. protect anywhere but are very heavy, can be used only by trained men, and need frequent attention; they are the only safe means for exploring mines and places with high gas concns. Gas masks contg. 600 cc. activated charcoal protect against low concns. of org. vapors and of acid gases. Special masks can be made to protect for a short time against  $\text{NH}_3$  in concns. as high as 3%. In air with less than 3% CO special gas masks equipped with Hopcalite protect. In stronger concns. of CO the masks protect but the intense heat produced is unendurable. With mixed gases a gas mask with two or more of above absorbents protects for a short time. In dusts, smoke and mists gas masks with cotton-wool filters protect.

HOWARD E. BATSFORD

**Atmospheric conditions and physiological effects produced on trainmen by locomotive smoke in the Aspen and Wahsatch tunnels of the Union Pacific Railroad.** S. P. KINNEY. *Bur. Mines, Repts. Investigations* No. 2494, 15 pp. (1923).—Asphyxiation due to exposure to CO and exhaustion due to high temp. and high humidity are the main causes of accident to trainmen in the tunnels investigated. Physiol. tests over a period of 10 min. showed that the condition in the cabs might be severe enough to cause asphyxiation or exhaustion in periods of 20 min., especially in cases where the engine is stalled. On account of the combined actions of CO, high temp., high altitude and high humidity it is doubted if ordinary gas masks are applicable to this case. The train air-brake line may be used as a source of air for breathing purposes for a period of 10 min. In combination with the air tanks acting as a reservoir the supply of air would last (3 persons) 30 min. A respirator to cover the nose and mouth and to be attached to the air-line of the train is illustrated, described, and its advantages over the gas mask are pointed out. Smoke deflectors and an arrangement for reducing cab temp. and humidity will minimize the danger from exhaustion.

L. W. RIGGS

**Mechanical methods for the propulsion of gases.**

E. F. HOOPER AND B. B. WALLER. *J. Soc. Chem. Ind.* 42, 180-4T (1923).—The history of the gas exhauster is given. The app. most used in English practice, the rotary sliding blade exhauster, resulted from the failure of a steam engine of the same type invented by John Beale in 1860. The present type has more blades, the positive pressure types of 3 or 4 blades working best up to 70" water pressure, and the net capacity being 85% of the calcd. vol. when running against a medium back pressure. The efficiency is high and the power required is low, being  $= 144 VP/33000$ , where  $V$  = vol. free gas per min. in ft.<sup>3</sup>,  $P$  = total pressure in lbs./in.<sup>2</sup> against which exhauster is discharging. This ignores change of vol. due to compression and also the friction loss in the machine, which adds about 40% of the H. P. The friction losses are lower in machines of smaller capacity and in those discharging against lower pressures. Compressors differ from exhausters in their design; the vol. reduction is very appreciable and must be allowed for. A double-blade machine allows a reversal of flow, using more power and causing a pulsating discharge. The 4-blade type overcomes this and passes 30% more gas, as well as saving on the power (10% at 5 lbs. pressure). The slippage is also decreased. At higher pressures, reciprocating or double-acting compressors are used. High speed turbo fans are advantageous for large vols. at low pressures but admit of small variation of load under max. efficiency. Measuring outputs is best done by gasometer and next by orifice meter. In the case of reciprocating machines, a receiver should be added to dampen out pulsations.

P. D. V. MANNING

**Recent development of low-temperature technic.** F. POLLITZER. *Z. ges. Kälte-Ind.* 28, 125-33; *Chem. Zentr.* 1922, IV, 1005; cf. *Z. kompr. f. Gase* 22, 70; *Chem. Zentr.* 1922, IV, 617.—Cooling of the air through expansion is explained by means of a heat-temp. diagram at const. pressure. Equipment for the production of H from water-gas by means of liquid air and the most recent large scale app. for the production of O and N are described and illustrated. The method of sepn. of O and N is explained diagrammatically. The production of A and of Ne-He mixts. by the rectification of air is also described.

C. C. DAVIS

**Calculation of vapor recompression evaporators.** L. A. PRIDGON. *Chem. Met. Eng.* 28, 1109-11 (1923).—The thermodynamics of vapor recompression evaporators is discussed; and examples are given showing the calcn. of steam consumption, capacity, etc., by Mollier's diagram. The temp. drop of such an evaporator is automatically

detd. in operation by a balance between power input and heat losses. The temp. drop (and hence both economy and capacity) can only be approx. detd. in advance, but can be adjusted during operation by adjusting the losses. W. L. BADGER

**Comparative tests of drying with a direct current and with a countercurrent.** H. NERNST. *Apparatebau* 34, 118-9, 133-4, 150-2; *Chem. Zentr.* 1922, IV, 481.—On theoretical grounds, drying with air is more economical with a direct current than with a countercurrent, though with a direct-current exposure must be at a higher temp. and with less satd. air than with a countercurrent. This is because the capacity of the dry air for taking up  $H_2O$  is great at first but is very slow above 20% satn.; therefore it is uneconomical to carry the satn. further than 20%. C. C. DAVIS

**European practice in cooling chemical liquids.** A. THAU. *Chem. Met. Eng.* 29, 98-102(1923).—A comparison of (1) coil coolers, (2) multitubular coolers and (3) box coolers shows that type (1) is the simplest, and the one in which leaks are plainly visible. Type (2) is more efficient than (1); its foundations need not be so heavy, a unit can be cut out without disturbing the flow, and if desirable the cooler can be used as a heat interchanger. One disadvantage, especially where long pipes are used, lies in the tendency on the part of the internal tubes to sag in the middle, touch one another and obstruct regular flow. Type (3) possesses the same advantages over type (1) as does type (2) without its disadvantages. Cooling tubes of larger diam. can be used; they can be kept clean, moved easily and can be readily removed and exchanged. In both types (2) and (3) leaks should be tested for daily by examination of both effluents. T. describes the constriction (drawings and photographs) and functioning of all three types. Direct-acting coolers can be used in cases where the cooling and hot liquid do not mix and are of different densities (e. g., water and oil). A diagram of one for cooling oil heavier than water is given. The cost of construction and of upkeep is much less than for tubular coolers but the field is quite limited. E. G. R. ARDACH

**The enrichment and preparation in a pure state of gases from gaseous mixtures by means of substances having large areas per unit weight.** E. BERL AND O. SCHMIDT. *Z. angew. Chem.* 36, 247-53(1923).—Materials of great area per unit mass, like activated carbon, colloidal  $SiO_2$ , zeolites, etc., can be used to enrich gas mixts. in certain constituents, and even to prep. these constituents in almost a pure state by a process similar in theory to the fractional distn. of liquids. Under the same conditions of temp. and pressure more of the gas with higher b. p. will be adsorbed than of that with the lower, and with gases of the same b. p. the material of higher mol. wt. will be taken up better by the adsorbent. A condition of equil. of satn. of adsorbent is established depending upon the compn. of gases subjected to treatment. If now the more easily adsorbed material is sepd. from the adsorbent by heating, blowing with steam or other gases, and the process repeated with the adsorbent, a yet higher concn. of the more easily adsorbed component will be obtained. For example,  $C_2H_4$  and  $CH_4$  can be sepd. from a mixt. contg. these gases with H, O, N, etc., by activated charcoal. Gas was passed from a gasometer in a const. stream through a current meter, gas interferometer, tubes contg. activated C and then to collectors, thus allowing the progress of the change to be followed closely. Analytical results, curves and their interpretation are given in full. It is shown that a gas mixt. had its  $C_2H_4$  content raised from 17.08% to 64.20, 90.90 and 98.8% by successive treatments with activated C and at the same time  $CH_4$  was altered from 37.2% in the original mixt. to 51.05 and 72.5% in the effluent gases from the above trials. Additional expts. using  $C_2H_6$  vapors to expel  $C_2H_4$  confirmed these results. W. C. BRAUGH

**Dirty steam no longer necessary.** L. F. KUHMANN. *Blast Furnace & Steel Plant* 11, 340-1, 347(1923).—The failure of the "dry pipe" to deliver absolutely dry steam is the cause of the transference of impurities and chemicals into the steam system and engines. Graphs show the solids carried over with varying %  $H_2O$  in the steam and the slight effect which "blowdown" practice has upon boiler concn. and upon the solids carried over into the steam system. Emphasis is laid on the inadequacy of changing the treating system or increasing the no. of "blow-downs" and the necessity for improved and efficient types of dry pipes. C. C. DAVIS

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**Treating solids with liquids.** DORR CO. Brit. 190,727, Dec. 21, 1922. In treating solid and liquid mixts. to remove solids by sedimentation, sepg. quickly settling solids from solids in suspension, etc., discharge of thickened material from the body of the pump is automatically effected in response to the rate of accumulation of solids therein. The hydrostatic pressure of the discharging solids is opposed by a pressure obtained from a pulp of less density, such as a mixt. of discharged material and a liquid diluent. A suitable construction is specified.

**Evaporating liquids.** E. WIRTH-FREY. U. S. 1,461,640, July 10. Liquid is heated by internal heating coils and vapors evolved are compressed and used in part for heating the coil and in part are directly forced into the lower portion of the body of liquid in the evapg. chamber.

**Utilizing capillary flow.** L. LUMIÈRE. Brit. 190,148, Dec. 6, 1922. The passage of a liquid or liquids through a permeable fabric under the combined influence of capillarity and siphon action is utilized in a variety of operations such as carrying out chem. reactions between liquids; the dyeing, bleaching, and dressing of fabrics; tanning; washing; and dialytic extn. A suitable construction is specified.

**Cleaning air or other gases.** A. G. MCKEE. U. S. 1,459,982, June 26. Cleaned gas is withdrawn from the center of a rotating column of the gas as it is cleaned centrifugally.

**Volatilization; lead oxide.** T. GOLDSCHMIDT AKT.-GES., L. SCHERTEL and W. LÜTY. Brit. 190,157, Dec. 6, 1922. The production of solid substances in a finely divided state by volatilization is effected by causing the raw materials to be volatilized as they are passing over, or being otherwise brought into motion relative to bodies of large superficial area. The raw materials may be passed over such bodies either in the fused state or in the form of granules, and in the latter case motion may be applied to the bodies of large superficial area. Alternatively the raw materials may be allowed to drizzle down a shaft packed with heat-resistant porous bodies. Relative movement between the bodies of large superficial area and the raw materials may be produced in any other way, e. g., by means of perforated disks which are caused to gather or lift the raw material, or which may be flooded intermittently therewith. In each case, sufficient heat is applied to effect volatilization, which may be accompanied by chem. change brought about by suitable reaction gases. The invention is illustrated by reference to the production of finely divided PbO by allowing litharge or molten Pb to drizzle down a heated shaft packed with heat-resistant porous filling bodies, such as magnesite clinker, or chrome Fe ore in lumps.

**Preventing frost crystals in circulating lines of refrigerating machines.** H. J. SMITH. U. S. 1,460,352, June 26. A refrigerant such as EtCl or MeCl is mixed with alc. or other liquid highly miscible with H<sub>2</sub>O and a non-freezing sludge forming in the lines is collected in low spots to prevent interference with the circulation.

## 14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW AND G. C. BAKER

**The Württemberg water supply.** HANNEMANN. *Die Wasserkraft* No. 2, 11-14; No. 3, 26-9; No. 4, 41-44(1923); *Gesundh. Ing.* 46, 168(1923). M. E. F.

**Water supply of Davos.** RUTISHAUSER. *Monthly Bull. Gas u. Wasserfachmännern*, Zurich 3, 1923. M. E. FLENTJE

**Water supply for a new city in India.** ANON. *Eng. News-Record* 90, 841(1923).—The water supply for Delhi is described. FRANK BACHMANN

**Safe water supplies for rural Saskatchewan.** R. H. MURRAY. Dept. of Public Health, Saskatchewan, Canada, *Sanitation Bull.* No. 2, 28 pp.(1923).—A survey of the Province has indicated that the commonest cause of well pollution is thoughtlessness in selecting a suitable site. The av. well water in the Province contains approx. 100 grains per gal. of mineral salts with  $\text{CaSO}_4$  predominating and the remainder consisting of  $\text{MgSO}_4$ ,  $\text{Na}_2\text{SO}_4$ ,  $\text{CaCO}_3$ ,  $\text{Na}_2\text{CO}_3$  and  $\text{NaCl}$  in amts. decreasing in the order given.  $\text{Na}_2\text{SO}_4$  is sometimes present to the extent of 4-5000 grains per gal. All the surface water supplies of the Province are dangerous. Where ice is cut in winter for use as water supply during the yr. there should always be a depth of at least 2 ft. of water under the ice when cut, and the surface of the ice should be scraped free of snow, soft ice and foreign matter before storing. As an added precaution the ice, when melted, should be sterilized. In some sections of the Province rain water is the only source of supply. A plant consisting of raw water tank, sand filter and filtered water storage tank and based on an annual rainfall of 12 in. on a roof area of 3000 sq. ft. is described and illustrated. R. E. THOMPSON

**Twenty-eighth annual report, Superior Board of Health, Quebec.** (1921-2). 412 pp.—The improvement effected in river water supplies has reduced the typhoid death rate in the Province to 18.0 per 100,000. Further research was carried out on detection and differentiation of organisms of the colon-aerogenes group; and application of H-ion concn. to purification plant control. These studies are still in progress. R. E. THOMPSON

**Aeration experiments for removal of carbonic acid.** WELLINGTON DONALDSON. *Eng. News-Record* 90, 874-6(1923).—The water supply of Memphis, Tenn., is taken from wells. The water contains 110 p. p. m.  $\text{CO}_2$  of which 75 to 80% is removed in pumping with air-lift pumps. It was desired to reduce the  $\text{CO}_2$  to 10 p. p. m. or less by aeration. After carrying on extensive expts. with various types of aerating devices, a multiple-tray coke scrubber type of aerator was adopted for the 18 m. g. d. purification plant under construction. There will be 40 tray units each about 2 x 7' in plan, made up of 4 superimposed trays of coke 10" deep, spaced 9" vertically. FRANK BACHMANN

**Work of the Bureau of Laboratories during 1922.** WM. H. PARK. N. Y. City Dept. of Health *Monthly Bull.* 13, 73-88(1923).—Drinking waters contg. *B. coli* in quantities less than 10 cc. or a total bacterial count much in excess of 100 per cc. are listed as suspicious or polluted, but repeated tests and careful consideration of local conditions are necessary to judge the quality of a source of supply. The standards for bathing pools using well, spring or city water permit the presence of not more than 10 *B. coli* per cc. If river or harbor water is used it must not contain more than 30 *B. coli* per cc. The method of examn. of shell fish consists of 5 parallel tests of the pooled liquor of 5 or more oysters. The liquor must contain less than 50 *B. coli* per cc. The operation of the oyster purification plant at Inwood, Long Island, has resulted in a considerable reduction in the *B. coli* present in the oyster liquor. R. E. T.

**Aeration of water immediately after alum dose saves soda.** MALCOLM PIRNIE. *Eng. News-Record* 90, 883-4(1923).—Expts. with alum and soda as coagulants showed that by aerating the water immediately after the addn. of the chemicals, an excellent floc formed with less chemicals than without aeration. Aeration liberates the  $\text{CO}_2$ , thus lowering the acidity and giving more favorable conditions for floc formation. F. B.

**Some notes on water in tannery practice.** A. HARVEY. *Leather World* 15, 392-3, 476-7(1923).—A consideration of methods for purifying various kinds of natural waters to make them suitable for each of the several tannery processes. J. A. WILSON

**Water purification at the Stuttgart swimming pool.** E. LINK and R. SCHABER. *Gesundh. Ing.* 46, 206-9(1923).—These baths are used by 590,000 bathers per yr. The water is purified by means of rapid filters and  $\text{Cl}$  gas.  $\text{Cl}$  gas, fed at the rate of 0.1 g.-0.3 g./cu. m., gives a bacteria-free water. The water is used  $\frac{1}{4}$  yr. without change. Complete illustrations and plans of the pool and equipment are given. M. E. F.

**The importance of chlorine in water purification.** H. SELTER and W. E. HILGER. *Gesundh. Ing.* 46, 126-8(1923); *Gas u. Wasserfach* 66, 292.—Treatment with  $\text{Cl}$  gas results in the complete destruction of bacteria, disproving the idea that bacteria in  $\text{Cl}$ -treated water regain their power of causing infection. MARTIN E. FLENTJE

**The detection of *B. coli* in drinking water.** W. OLSZEWSKI and H. KOHLER. *Gesundh. Ing.* 46, 136(1923); *Gas u. Wasserfach* 66, 292(1923).—The quickest results are

obtained by (1) direct cultures, (2) indirect cultures in a suitable nutrient medium. The regular or frequent appearance of *B. coli* in 1 cc. of water is considered to be suggestive of infection at least. A water supply in which the appearance of *B. coli* is regular or frequent can best be purified with Cl gas. MARTIN E. FLENTJE

A new color reaction for the detection of nitrous acid. A. ZLATAROFF. *Z. anal. Chem.* 62, 384-5(1923).—To test for  $\text{HNO}_2$  take 10 cc. of the water, add 2 cc. of a 0.0025% aq. soln. of neutral red, mix well and add a little dil.  $\text{H}_2\text{SO}_4$  or HCl. An intense blue color is produced if 0.005 mg. of  $\text{HNO}_2$  is present per l. of water. W. T. HALL

New water purification plant at Norfolk, Virginia. W. H. TAYLOR, III. *Eng. News-Record* 90, 824-5(1923).—The plant consists of weir aerators, coagulation basins and twelve 1 m. g. d. filters. The water is treated with alum and aerated before sedimentation and filtration to remove  $\text{CO}_2$  and odors. FRANK BACHMANN

Detroit 320-m. g. d. filtration plant is world's largest. T. A. LEISEN. *Eng. News-Record* 90, 860-5(1923).—Some of the special features of the plant include: higher rates of filtration than usual, revolving screens for ice removal, steel roofs over filters and coagulant basin, triangular spacing of columns in the filtered-water basin and rapid mixing at high velocities. FRANK BACHMANN

Water filtration plant for Omaha metropolitan district. F. P. LARMON. *Eng. News-Record* 90, 870-1(1923). FRANK BACHMANN

Overhauling outgrown water-works at Fort Smith, Ark. WYNKOOP KIERSTED, JR. *Eng. News-Record* 90, 878-9(1923). FRANK BACHMANN

The storage and distribution of water. E. B. BALL. *Engineering* 116, 27-31 (1923).—About improvements in mech. contrivances for this purpose. E. J. C.

Railway water treatment plants and their operation. F. D. YEATON. *Eng. News-Record* 90, 877(1923).—Close control of the operation of the treatment plants is essential. FRANK BACHMANN

Waste water in the industries and technical trades. CLEMENS DELKESKAMP. *Wasser* 17, 123-5(1921); 18, 12-4, 42-4(1922); *Chem. Zentr.* 1922, IV, 230.—A discussion of the economic aspects of the purification of waste  $\text{H}_2\text{O}$ , recovery of useful products and the use of purified  $\text{H}_2\text{O}$  again. C. C. DAVIS

Some chemical changes which occur in samples of excretionally polluted water under certain specified conditions. R. C. FREDERICK. *J. Hyg.* 21, 220-5(1923).—Water samples should not be stored in the light because green algae will greatly increase the amt. of albuminoid  $\text{NH}_3$ . 0.1 part. of Cu per 100,000 greatly restrained the production of free  $\text{NH}_3$  and prevented its conversion into nitrites and nitrates. Zn, Pb, and Fe had similar but decreasing effects in the order named. 30 parts per million of Cl completely prevented the formation of free  $\text{NH}_3$ , nitrites and nitrates. JOHN T. MYERS

The near future of the waste-water problem in the Netherlands. JAN SMIT. *Chem. Weekblad* 20, 358-61(1923).—The purification of waste water by means of Cl which is merely a deodorization is not satisfactory. Legislative measures are recommended. R. BEUTNER

Importance of oxygen and stirring for activated sludge growth. A. M. BUSWELL. *Eng. News-Record* 90, 835-7(1923).—Tests indicate that forced aeration is unnecessary as little O is needed for growth in activated sludge. Stirring seems to be more important. Indications point toward a process in which the air surface and flocs would be held stationary while the liquid flows past them. FRANK BACHMANN

Imhoff tank and sprinkling filter studies at Plainfield (N. J.) works. WM. RUDOLFS. *Eng. News-Record* 90, 779-81(1923).—The studies indicate that the more abundant bacteria in the Imhoff tank are those which attack the most easily digested protein material. Flagellates and ciliates are few in nos. and increase with increasing depths. A too alk. reaction and excessive gas production result in foaming difficulties. The film on sprinkling filters is composed largely of bacteria, microscopic animals and occasional fungi. The latter are particularly abundant during early spring and fall months. Expts. on dehydration of sludge with acid and alum seem promising in reducing drying periods of the sludge. FRANK BACHMANN

Sewage disposal for rural homes in Saskatchewan. R. H. MURRAY. Dept. of Public Health, Saskatchewan, Canada, *Sanitation Bull.* No. 1, 20 pp.(1923).—Septic tanks are the simplest and most practical form of sewage treatment for the farmhouse on the prairie. The principles, location, construction and operation, and methods of effluent disposal which are applicable under various conditions are described and illustrated. R. E. THOMPSON

Decline in typhoid and other death rates. ANON. *Eng. News-Record* 90, 828 (1923).—Public Health Repts. (Feb. 23, 1923). F. B.

**Rural and semi-urban sanitation.** F. A. DALLYN AND A. E. BERRY. Provincial Bd. of Health, Ont., *Bull.* No. 9, 69 pp. (1922).—Water supplies, fly control, dairy farm sanitation, plumbing instructions, sewage disposal and rural school sanitation are discussed. The pollution of wells by surface and underground water and the factors influencing the longevity and depth of penetration of pathogenic organisms in soil are included. Investigations have shown that pathogenic organisms will not pass beyond a distance of 10 ft. even in porous sandy soil and seldom more than 1 ft. in very dense clay. Control of flies by larvicides and fly traps is described. Ninety % of house flies are hatched in manure piles; hence control efforts should be directed against such breeding grounds. Septic tanks and chem. closets are described and details of their construction and operation are given. The latter are considered to be particularly suitable for rural schools in the absence of municipal sewers. R. E. THOMPSON

**The fumigation of ships with Liston's cyanide fumigator.** W. G. LISTON AND S. N. GORE. *J. Hyg.* 21, 199-219 (1923).—A detailed description of the machine for fumigating ships is given. It is safer and more efficient than the dumping fixture. J. T. MYERS

**Distilling water.** J. CALAFAT. *Brit.* 189,879, Sept. 9, 1921.  $H_2O$  flows from a tank over the top of a drum and down the fabric-covered outer surface of a drum, star-shaped in cross-section, through the interior of which hot gases rise from a burner. The gases are deflected against the walls of the casing by a baffle. The  $H_2O$  vapors are condensed on the inner surface of a water-jacketed drum and condensate flows through an outlet. Unevaporated  $H_2O$  passes to an outlet. The distd.  $H_2O$  may be hardened by adding to the  $H_2O$  in the tank materials which evolve  $CO_2$ , e. g.,  $NaHCO_3$  and tartaric acid, and passing the distd.  $H_2O$ , in which some of the gas becomes dissolved, through a tank contg. marble.

**Removing oil from condensed water.** SHIROJI HATTA AND THE MITSUBISHI ZÔSEN KABUSHIKI KAISHA. Japan. 41,579, Jan. 28, 1922. Since oil emulsion in  $H_2O$  is charged with negative electricity, it can be sep'd. by mixing with a colloidal soln. positively charged.  $Fe(OH)_3$  prep'd. chemically or electrolytically, is suitable. For quick clarification, it is filtered through sand, charcoal, coke, etc. The quantity of  $Fe(OH)_3$  to be added depends on the amt. of oil in the  $H_2O$  and its purity after clarification. E. g., 1 ton of  $H_2O$  contg. about 0.005% oil is mixed with 12 g. of  $FeCl_3$  and then with 6 g. of NaOH and filtered through sand; the oil content is decreased to less than 0.0005%. For electrochemical treatment of the same water, d. c. of 2.5 amp. hr. is required with Fe rods as the electrodes.

**Softening water for ice making.** R. ELLIS. U. S. 1,460,646, July 3. After treating  $H_2O$  with lime or other reagents for the removal of a large part of the Ca and Mg salts present, a substance such as  $NH_4Cl$  is added to the  $H_2O$  before freezing it, to increase the soly. of the Ca and Mg compds. remaining in the  $H_2O$ .

**Apparatus for purifying water for steam boilers.** E. J. BROCK. U. S. 1,459,820, June 26.

**Garbage incinerator.** W. F. BORN. U. S. 1,461,108, July 10.

Wastes from the textile industry in Russia (DROSDORF) 25.

MISTRANGELO, CLAUDIO: *Provvista e distribuzione di acqua potabile.* Milan: U. Hoepli. 389 pp. L. 36.

## 15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

**The lateritic nature of our soils. Investigations on river muds.** A. DE DOMINICIS. *Ann. scuola agr. Portici* [2] 15, 1-23 (1920).—Lateritic soils, because of their behavior towards  $H_2O$ , are of special importance in arid climates in connection with the deficiency and poor distribution of atm. pptn. and many of the fundamental principles which directly concern fertility are connected with the nature of lateritic soils. Laterite formation is characteristic of hot climates, whether moist or arid. In arid climates all the products of laterite formation remain insol. on the spot in the same proportions in which they are formed and it is difficult to sep. and identify them by chem. analysis. The sepn. is more easily accomplished by artificial levigation. This occurs naturally through the action of the running  $H_2O$  that is enchanneled in rivers and the examn.



of river muds is interesting for this reason and because it can serve as an indication of the nature of the soils of entire regions. Muds were secured from 8 rivers (in all cases but 2 from the deltas or mouths) and subjected to the Schloesing phys.-chem. analysis and to the v. Bemmelen analysis. The v. Bemmelen method was also applied to the portions of the muds secured by levigation with the Appiani app. The lateritic ratio (no. of mols. of  $\text{SiO}_2$  per mol. of  $\text{Al}_2\text{O}_3$ , in the portions sol. in hot concd.  $\text{H}_2\text{SO}_4$  and hot concd.  $\text{HCl}$ , <3) commences to appear toward the more southern part of central Italy and extends southward.

ALBERT R. MERZ

**Valuable peaty soils.** T. D. HALL. *J. Dept. Agr. Union S. Africa* 6, 504-10 (1923).—Analyses of 4 types of S. African peat soils gave:  $\text{H}_2\text{O}$  5.70 to 16.81%, org. matter 21.11 to 64.32%, silica 17.02 to 54.04%,  $\text{Fe}_2\text{O}_3$  and  $\text{Al}_2\text{O}_3$  2.15 to 15.59%,  $\text{CaO}$  0.34 to 2.52%,  $\text{MgO}$  0.06 to 0.61%,  $\text{P}_2\text{O}_5$  0.13 to 0.20%, N 0.76 to 1.95%. K. D. J.

**Some considerations on the formation and the properties of agricultural soil.** GIORGIO ROSTER. *Atti accad. Georgofili* [5] 19, 57-80 (1922).—An address dealing with (1) processes of erosion and of demolition of rocks; (2) influence of climate on the alteration of rocks; (3) phys.-mechanical processes and meteoric erosion; (4) transportation and deposition of detrital materials; (6) minerals of agricultural soils; (7) phys. and chem. properties of agricultural soil.

ALBERT R. MERZ

**A new fertilizer sampling tube.** L. D. HAIGH. *J. Assoc. Offic. Agr. Chem.* 6, 410-3 (1923).—The tube removes from a bag a core of fertilizer from top to bottom.

M. S. ANDERSON

**Mineral content of alfalfa increased by fertilization.** O. B. PRICE. Michigan Agr. Expt. Sta., *Quart. Bull.* May 1923, 158-9.—First-cutting alfalfa grown in a light sandy, acid soil contained on the untreated soil 0.56% Ca and 0.054% P; on the soil to which 2 tons of limestone per acre were applied 2.98% Ca and 0.179% P; on soils to which 250 lbs. limestone per acre of acid phosphate were added 2.63% Ca and 0.209% P. The hay at the 2nd cutting contained: for that grown on untreated soil 1.52% Ca and 0.259% P; for that grown on soil treated with limestone 1.82% Ca and 0.255% P; for that grown on soil treated with limestone and acid phosphate 1.63% Ca and 0.31% P.

J. J. SKINNER

**Fertilizing experiments with hemp and the stinging nettle (*Urtica*) in receptacles under varying conditions of moisture.** BR. TACKE. *Faserforschung* 2, 113-26; *Chem. Zentr.* 1922, III, 752.—Though the  $\text{P}_2\text{O}_5$  content of the solid material of marshes was 4 times as great as the  $\text{K}_2\text{O}$  content, hemp and nettle showed a great need for  $\text{P}_2\text{O}_5$ . After fertilizing with  $\text{K}_2\text{O}$  only a slight effect was observed with hemp, whereas nettle could supply its need of  $\text{K}_2\text{O}$  with the low  $\text{K}_2\text{O}$  content in the soil (0.05% of the dry material). As the plants developed, their requirements of N increased greatly.

C. C. DAVIS

**Report of chemical control committee of National Fertilizer Association.** C. F. HAGEDORN, et al. *Ind. Eng. Chem.* 15, 864 (1923).—Definitions of phosphatic slags, lime and shredded manures are given. The Devarda method as applied to com. nitrate and Moore's method for N were proposed for study. The official method for detg. insol.  $\text{P}_2\text{O}_5$  in fertilizers was adopted for detg. insol.  $\text{P}_2\text{O}_5$  in pptd. phosphates. It was proposed that 1-g. instead of 2-g. samples be used and that the use of Sherrill's centrifugal method for K detn. be discontinued.

J. J. SKINNER

**N. P. K. fertilizer.** E. L. PEASE. *Gas J.* 162, 742-3 (1923).—The production of a fertilizer contg. N, phosphates and potash is described. Crude and dil.  $\text{H}_3\text{PO}_4$  is added to the desired amt. of  $\text{K}_2\text{SO}_4$  and the soln. is mixed with a finely ground base material such as coke, peat, shale, clay, etc. Peat is particularly mentioned as having essential fertilizing properties. This acid base material is used to strip the  $\text{NH}_3$  from coal gas, forming  $(\text{NH}_4)_2\text{HPO}_4$  or  $(\text{NH}_4)_4\text{PO}_6$ . The efficiency of extrn. is from 98 to 99.8%. One ton of N. P. K. with a strength of 4-6%  $\text{NH}_3$  and 12-18%  $\text{H}_3\text{PO}_4$  and  $\text{K}_2\text{O}$  as required is equiv. to 21 cwt. of mixed superphosphate and  $(\text{NH}_4)_2\text{SO}_4$  with the further advantages of non-acidity, soly. and impregnation besides a saving of from 50 to 66 2/3% of  $\text{H}_2\text{SO}_4$ .

J. L. WILEY

**Theoretical and experimental contributions to the utilization of nitrogen in animal excretion.** WALTER ZÖLLER. *Fühlings Landw. Ztg.* 71, 289-306; *Chem. Zentr.* 1922, IV, 879.—A sepn. of feces and urine or of stable manure and liquid manure is attended with great difficulties and expense and the complete utilization of the N contained in these products is possible only under unusual expense. The use of preservatives recommended heretofore ( $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{NaHSO}_4$ ,  $\text{CH}_3\text{O}$ , K salts, superphosphate and  $\text{KNO}_3$ ) either is not economical or is technically difficult. A suitable method is that of Stutzer (*C. A.* 14, 2391), by which  $\text{CaCl}_2$  is intimately mixed with peat dust in a kneading machine, giving the so-called lime-peat. The N losses of the stable manure mixed

with the lime-peat either in the stable or on the compost heap or while spreading are of no practical importance. A fertilizer of similar effect can be prepd. by mixing 50 kg. of peat with 13 liters of foots, whose effectiveness is due to  $MgCl_2$ . On account of the great soly. and instability of the  $MgCO_3$  formed by the action of  $MgCl_2$  on  $(NH_4)_2CO_3$ , the soil to be treated with stable manure mixed with Mg-peat must contain sufficient lime to prevent decalcifying of the soil.

C. C. DAVIS

**The determination of cyanamide nitrogen in calcium cyanamide by Neubauer's method.** W. WAGNER. *Z. angew. Chem.* 36, 19–20(1923).—Neubauer's method (*C. A.* 15, 487) for the detn. of available N in  $CaCN_2$  can be successfully used in place of Caro's Ag method (*C. A.* 5, 1021). The results of recent expts. are presented in confirmation. With some samples, however, the former method gave 0.2–0.5% lower values. To det. whether, in these cases, the total cyanamide N in the residue after extn. with  $(CH_3)_2CO$  was not reduced to  $NH_3$  by nascent H, such samples were carefully extd. with  $(CH_3)_2CO$  and the N of the residue was detd. by the Kjeldahl method. Under the conditions one sample gave a better analytical result than with Neubauer's method; a second gave a result of 0.2% more than the total N of the original; a third, which gave by Neubauer's method 0.45% less N than the total, gave only 0.1% higher after extn. and digestion.

P. R. DAWSON

**Use of calcium carbonate in nitrogen fixation experiments.** P. L. GAINNEY. *Sci. Proc. Soc. Am. Bacteriologists* Dec. 1921; *Abstracts Bact.* 6, 15(1922).—Study was made of 200 soils, the quantity of N fixed when they were inoculated into a mannitol medium in both the presence and the absence of  $CaCO_3$  being detd. Eighty-six % of the soils gave greater N fixation in the presence of  $CaCO_3$ . The number of soils capable of initiating the growth of *Azotobacter* was 20% greater when  $CaCO_3$  was used than when it was omitted.

JOSEPH S. HEPBURN

**Availability of potash in mixed fertilizers.** N. E. GORDON. *J. Assoc. Official Agr. Chem.* 6, 407–9(1923).—Low results for K in mixed fertilizers may be due to the presence of colloids of  $Fe_2O_3$  and  $Al_2O_3$ . These oxide gels are shown to be fairly strong adsorbents for K from certain salts, especially from the phosphates. Gels of Fe and Al which had attained max. adsorption from a soln. of  $KH_2PO_4$  were leached with water and mixed with sand and sweet potato seedlings were grown in the mixts. The increases in wt. of the plants showed that the unrecovered K was readily available.

M. S. A.

**Report on potash.** J. T. FOY. *J. Assoc. Official Agr. Chem.* 6, 399–402(1923).—The Lindo-Gladding method and various modifications of it for the detn. of K are discussed. This method is the best for available K in mixed fertilizers in spite of the fact that there is a small amt. of K lost by occlusion and a small amt. dissolved in 80% alc. The centrifugal method by Sherrill appears to be unsuitable as an official method. It is applicable, however, where quick approx. results are desired. It is recommended that a further study be made of the use of stronger alc. for first washing of the ppt. and that the use of weak acid in making the soln. in mixts. of acid phosphate and K be investigated.

M. S. ANDERSON

**Leucite as a source of agricultural potash.** V. MANVILLI. *Coltivatore* 69, 85–8, 149–53(1923).—Leucite displayed, in plot tests, a utility almost equal to that of KCl and  $K_2SO_4$ . Italo Giannobi (*La leucite: in natura nell'industria, come fonte di potassa agricola*. Osima, 1921) concludes, as a result of a systematic series of expts., that (1) leucite is an efficacious  $K_2O$  fertilizer, comparable in its effects with the ordinary German and Alsatian salts; (2) its beneficial action is most marked in soils rich in  $CaO$ , less in sandy soils and least in clayey soils; (3) its efficacy is manifested from the first year of application and tends to increase in successive years; (4) for complete fertilization,  $(NH_4)_2SO_4$  is to be preferred to  $NaNO_3$  in its presence.

ALBERT R. MEYER

**Report on boron in fertilizers.** J. M. BARTLETT. *J. Assoc. Official Agr. Chem.* 6, 381–4(1923).—The effect of B on the growth of beans was studied in a series of pot expts. The forms of B used were colemanite, ulexite, howlite and tourmaline. These minerals were added in varying amts. to the com. fertilizer used with the soil. B compds. insol. in  $H_2O$  but sol. in weak acids are as injurious to plants as  $H_2O$ -sol. compds. The Bartlett distn. method detcs. B in such compds; it is recommended as an official method for detn. of B in fertilizer materials. The Ross-Deemer method detcs.  $H_2O$ -sol. B only; it is recommended as an official method for this purpose.

M. S. ANDERSON

**The constitution and manurial value of low-grade basic slag.** D. N. MCARTHUR. *J. Soc. Chem. Ind.* 42, 213–6T(1923).—The results of microscopic examn. and chem. analysis of an open-hearth fluorspar slag of known history indicate that the chief constituents are: (a) apatite, 15%; (b) dicalcium silicate, 35%; (c) aluminates and ferrites; and (d) uncombined oxides of ferrous Fe and Mn, the two latter groups comprizing

the remaining 50%. Field expts. were conducted with a crop of swedes, in which the slag, in 2 degrees of fineness, 100 mesh and 16 to 100 mesh, was compared with controls receiving no mineral fertilizer, finely ground limestone, and limestone plus mineral phosphate and magnesia in such proportions as to equal the amts. of CaO and  $P_2O_5$  represented by the slag. The finely ground slag gave results, as indicated by increase in yield, superior to limestone alone and equalled only by the limestone plus phosphate. Later expts. with rhubarb on an impoverished soil demonstrated the same relations. Such results may be attributed to the dicalcium silicate; the possible role of this compd. in favoring  $P_2O_5$  assimilation is discussed. It is to be concluded that such slags of low  $P_2O_5$  content have a distinct fertilizing value in their lime content and could be used to replace ground limestone in practice. Furthermore, the markedly greater yields obtained in the above expts. with the finely ground slag, as compared with the coarser material, indicate the importance of fineness of division of a slag in favoring availability.

P. R. DAWSON

**Determination of carbon in vegetable mold.** L. J. SIMON. *Compt. rend.* 176, 1409-11 (1923).—In a conical flask place 25-30 g. of concd.  $H_2SO_4$ , 8 to 10 g. of  $Ag_2CrO_4$ , and 0.4 to 4.0 g. of the soil to be tested. Connect the flask with a gaged receiver graduated to 250 cc. Heat on the water bath in such a manner as to attain the boiling of the bath in 30 min., maintain at this temp. 4 min., then cool and read the vol. of the gas in the receiver at atm. pressure. From this vol. calc. the amt. of C in the sample. The whole process requires about 1 hr. Results by this process agreed closely with those by combustion with CuO; the process may be recommended where great accuracy is not essential. Moist combustion with  $CrO_3$  gives results too low because of the formation of AcOH.

L. W. RIGGS

**Destruction of alkaloids in the soil.** P. LAVIALLE. *Bull. sci. pharmacol.* 30, 321-5 (1923).—Flower pots were varnished several times inside and out to make them impervious to water, then furnished with soil. Seeds were planted and watered with dil. solns. of cocaine, strychnine and morphine, resp. Suitable controls were provided. The soil contains, or may contain, organisms capable of completely destroying large amts. of cocaine, strychnine and morphine.

L. W. RIGGS

**Experiments with arsenical dipping fluids.** LIONEL COHEN. *Agr. Gaz. N. S. Wales* 34, 107-15, 197-200, 268-70 (1923).—The official N. S. Wales dipping formula for the cattle tick, *Margaropus australis* or *Boophilus australis*, consists of  $As_2O_3$  8 lbs.,  $Na_2CO_3$  12 lbs., common hard soap 2 lbs., Stockholm tar 1 gal., water 400 gal. The effects produced by varying the amts. of the different constituents were studied. The official formula contains more As than is required to produce best results but at full strength it has no bad effect upon cattle or dairy cows in full milk. Arsenate alone up to 0.3%, or up to 0.2% combined with 0.1% of arsenite, has no noticeably injurious effect on cattle. Emulsion is not essential to the dip fluid, provided care is taken thoroughly to wet the skin. During the second moult ticks are able to resist the action of arsenical fluids at the commonly employed concns., and at less than half the usual arsenical strength the only surviving ticks appear to be those undergoing the second metamorphosis. The tick-killing power of arsenate is about one-third that of arsenite. Arsenical fluids appear to act more rapidly in summer than in winter. Dipping in weak solns. at short intervals appears more desirable than dipping in strong solns. at long intervals.

K. D. JACOB

**Neutral solution of ammonium citrate.** C. S. ROBINSON. *J. Assoc. Official Agr. Chem.* 6, 384-91 (1923); cf. *C. A.* 16, 607.—Former recommendations for the prepn. of neutral citrate solns. called for a definite ratio of  $NH_4OH$  to anhydrous citric acids using the limits 1:3.708 to 1:3.949. The direct detn. of reaction of the soln. appears to be more accurate and hence the recommendation is made that neutral citrate soln. be considered as one having a reaction of  $pH$  7.0  $\pm$  0.2.

M. S. ANDERSON

**Toxicity of copper with reference to molds.** RAPHAEL DUBOIS. *Compt. rend.* 176, 1498-1500 (1923); cf. M. and Mme. Villedieu, *C. A.* 15, 288, 2653; 16, 269, 2005.—Cu or its salts appear to destroy molds by an action comparable to that of zymases, oxidants and peroxidants.

L. W. RIGGS

Reaction of medium and growth of *Azotobacter* (YAMAGATA, WILSON) 11C.

FUNARO, ANGILOLO: I concimi. 4th ed. revised. Milan: U. Hoepli. 326 pp. L. 12.

**Superphosphate.** H. A. WEBSTER. U. S. 1,461,077, July 10. Powd. phosphate rock is introduced into a mixer simultaneously with  $H_3PO_4$  or a quantity of 52° B $\phi$ .

H<sub>2</sub>SO<sub>4</sub> less than that theoretically required to convert all the tri-Ca phosphate into mono-Ca phosphate, the powder and acid are mixed and the free H<sub>2</sub>O present is eliminated by aerating while hot to produce superphosphate. Cf. C. A. 17, 2765.

**Radioactive plant growth stimulant.** R. R. ADAMS. U. S. 1,461,340, July 10. A spray for plants is formed from a radioactive substance, e. g., Ra-bearing Ba salts, together with glue, casein or other adhesive. Pb arsenate or other insecticides or fungicides may be added to the mixt.

**Apparatus for making "lime sulfur."** R. TAKI. U. S. 1,460,621, July 3. The app. comprises a horizontal rotatable pressure tank provided with trunnions through one of which a steam pipe extends.

## 16—THE FERMENTATION INDUSTRIES

C. N. FREY

The fermentation theories up to the discovery of zymase. G. WOLFF. *Brennerzeitg.* 39, 23; *Chem. Zentr.* 1922, III, 836-7.—An historical survey of the theories of Lavoisier and Gay-Lussac. C. C. DAVIS

**Colorimetric estimation of the higher alcohols in spirituous liquors.** WILHELM MÜLLER. *Mitt. Lebensm. Hyg.* 14, No. 3, 105-15(1923); cf. Fellenberg, C. A. 5, 2690.—In the Fellenberg procedure the decompn. of acetal with H<sub>2</sub>SO<sub>4</sub> is unnecessary. After the destruction of aldehydes and terpenes the remaining alk. soln. must be weakly acidified in order to distil quietly. The colorimetric tests upon the distillate are carried out with samples contg. 10 vol. % of alc. Five cc. of the 10 vol. % alc. is mixed with 1 cc. of a 1% alc. soln. of salicylic aldehyde, 4 cc. of water is added and the estn. made in the colorimeter in the usual way. As a comparison standard a soln. contg. 10 vol. % EtOH, 1.5 per 1000 of abs. isoamyl alc., and 0.5 per 1000 of abs. isobutyl alc. may be used. **Wormwood wine.** *Ibid* 142-5.—Four samples of wormwood wine (vermouth) were analyzed. The sp. gr. ranged from 1.0039 to 1.0438, alc. 14.7 to 18.0 vol. %, total ext. 66.4 to 161.5 g. per l., invert sugar 44.1 to 141.2, cane sugar 1.5 to 57.8, total alc. as tartaric acid 4.3 to 6.5, volatile acids as AcOH 0.5 to 0.9, ash 1.4 to 2.5, sulfates less than 1.0. L. W. RIGGS

**Application of lactic acid to the preparation of wine from fruit, marc and lees.** F. MUTH. *Festsch. Jubiläum Hbh. Staatl. Lehranstalt für Wein-, Obst- und Gartenbau, Geisenheim a. Rhein*, 1922, 1-32.—Addn. to must made from pears, marc or lees of 0.2-0.3% of lactic acid produces marked improvement in the fermentation, whether spontaneous or brought about by pure yeast, the bacteria which affect these wines injuriously being sensitive to the increased acidity while the fermentative activity of the yeast is enhanced thereby. Especially suitable for this purpose is the com. lactic acid known as *Genußmittelsmilchsäure*, which contains 60% by weight of the acid and is prepd. by cultivating lactic acid bacteria at 50° in a mash prepd. from saccharified potato meal or starch in presence of Ca carbonate. Tartaric and citric acids behave similarly to lactic acid, but form sparingly sol. K and Ca salts, which partially sep. Methods are given for estg. the lactic acid and for checking its purity. J. S. C. I.

**Influence of tartaric acid on bacterial malic acid fermentation, the behavior of this acid on blending and its disappearance from wine.** F. MUTH. *Wein und Rebe* 4, (3), 1-32(1922).—If the fermentation of malic acid in wine by bacteria is prevented by the presence of an excessive proportion of tartaric acid, it may be induced by addn. of Ca carbonate in such proportion that the percentage of tartaric acid is reduced to 0.3. Addn. to must of tartaric acid causes sepn. of tartar and alk. earth tartrates, the ash content of the resulting wine being diminished. The bearing of these results on the blending of wines is discussed, and also the causes underlying the disappearance of tartaric acid from wines. J. S. C. I.

**Physiological properties of the Japanese vinegar ferment and their relation to the brewing of vinegar.** K. MIYAJI. *J. Soc. Agr. Soc. (Japan)* No. 235, 233-309; No. 238, 521-682(1922).—From 7 typical Japanese vinegar brewers, the samples were collected and 31 bacteria were isolated. Each vinegar ferment isolated was examd. for size, growth and its action on acid production from carbohydrates, including kind and quantity of the products obtained. The results of these systematic and elaborate exptl. data cannot be given even in a general summary. S. T.

**Waste molasses for fermentation purposes.** H. A. COOK. *Sugar* 25, 347-9 (1923).—The literature on glucose is reviewed. Analyses on samples of Hawaiian molasses indicate a conversion of glucose into glucose at the normal alk. of this molasses.

A glucose content in molasses of 6% materially affects the yields and costs when this molasses is used for fermentation purposes.

C. H. CHRISTMAN

**Preparation of pure dry pitching yeast.** J. RAUX AND E. BLOCH. *Bull. No. 1, Fondation Brasserie et Malterie Françaises. Brewers' J.* 59, 40-1(1923).—To prevent the occurrence of autolysis and contamination of pure yeast during drying, the latter must be very rapid, and the time of contact with the air a minimum. The following procedure is found to fulfil these conditions. Pure yeast is prepd. by the Hansen method, the wort being then decanted off and cold water added; the pasty mass is passed into sterile 2-l. Pasteur flasks, in which the yeast is allowed to settle for a few hrs. and the water then poured off. To eliminate the water still remaining, use is made of porous plates about 2 cm. thick, these being wrapped in paper and sterilized at 150°. With every precaution to prevent contamination, the yeast is poured rapidly on to one of the plates, which is immediately covered with a second plate. After the lapse of a few minutes, the upper plate is removed and the yeast quickly transferred by means of a sterile spatula to a glass dish and placed under a bell-jar covering, also a dish of strong  $H_2SO_4$ . If the bell is evacuated, the yeast becomes completely dry in 24 hrs., and is then transferred to flasks or tubes with waxed corks. 60 g. of yeast thus obtained corresponds with about 200 g. of pressed yeast, and actual brewery expts. with it yield results as good as those furnished by liquid pure-culture yeast.

J. C. S. I.

**Action of yeast on calcium lactate: production of ethyl alcohol.** E. KAYSER. *Compt. rend.* 176, 1662-5(1923).—Different races of yeasts were sown in solns. of Ca lactate contg. the usual other minerals. The amts. of pyruvic acid produced by the different yeasts, without and with the addn. of  $CaCO_3$ , in g. per 1000 g. of culture were: with wine yeast 2.15, 3.03, brewer's yeast 1.60, 2.86, dairy yeast 2.41, 2.68, resp. The oxidation was more intense with a combination of the yeasts than with any one used alone. The action was attended by the evolution of an agreeable odor which was caused by a mixt. of ethyl valerate and amyl acetate and perhaps some alc.

L. W. RIGGS

So-called furfural reaction of sake and soy (KODAMA) 10. Yeast extracts (Brit. pat. 190,147) 12.

HARDEN, ARTHUR: *Alcoholic Fermentation*. 3rd Ed. London: Longmans, Green & Co. 194 pp. 6s. 6d. net.

## 17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

**Salicylic aldehyde in perfumery.** ADELAIDE LABO. *Riv. It. essenze profumi* 4, 27-8; *Chem. Zentr.* 1922, IV, 443.—Data are given for the prepn. of salicylic aldehyde, its conversion into coumarin and the use of the latter in perfumery.

C. C. DAVIS

**The preparation of synthetic perfumes.** A. LEWINSOHN. *Riv. It. essenze profumi* 4, 42-3; *Chem. Zentr.* 1922, IV, 442; cf. C. A. 17, 2031.—The production of methyl heptinate by the process of Moureu and of geranyl formate is described; these are used to prepare violet and rose perfumes, resp. Geranyl formate is obtained by letting stand for 8 days pure geraniol with concd.  $HCO_2H$ . If the acid is not of high concn. geraniol should be replaced by its solid  $CaCl_2$  compd.

C. C. DAVIS

**Sundew.** B. A. VAN KETEL. *Pharm. Weekblad* 60, 761-4(1923).—A new test useful in the identification of ext. or tincture of *Drosera* is based upon the presence of a volatile pigment. Steam-distn. of an acidified ext. gives a yellow distillate which becomes purplish red on the addn. of a few drops of  $NaOH$  or  $NH_4OH$ . This reaction is very delicate.

A. W. DOX

**Cultivation and use of buchu (*Barosma betulina*) in South Africa.** R. H. COMPTON AND J. W. MATTHEWS. *J. Dept. Agr. Union S. Africa* 2, 223-8(1921); *Bull. Agr. Intell.* 12, 570-1.—In the green state the leaves of *B. betulina* yield approx. 1% volatile oil on distn., the twigs approx. 0.5%. Considerable loss of oil occurs during drying of the plant. The oil from the leaves is a clear, mobile yellowish liquid, from which a mass of colorless needles of diosphenol or Barosma camphor crystallizes on cooling. Oil from the twigs is deficient in this camphor. This is also true of the oil from leaves of *B. crenulata*. Used internally, the oil has a marked effect on the mucous membrane. Drying of buchu should be done as quickly as possible, and should be carried out in the shade to obtain a good color. The product should be as green as possible to insure

minimum loss of oil, and should contain not more than 10% of small green twigs and no larger twigs if intended for export. The cultivation of the plant is also described.

JOSEPH S. HEPBURN

**Histamine and histamine-like substances in lymphagogs.** K. AOKI. *J. Japan Railway Med. Officers' Assoc.* 8, No. 11(1922); *Japan Med. World* 3, 88(1923).—All of Heidenhain's first class lymphagogs contained histamine or histamine-like substances.

M. E. MAVER

**Ointment bases.** A. SEIDEL. *Wiener klin. Wochschr.* 36, 240-1(1923).—A study of the suitability of 2 com. preps., Hydrolan and Anhydrolan, as bases for various ointments used in skin and venereal diseases. Favorable results are reported.

W. A. PERLEWEIG

**Content of various rhubarbs in anthracene derivatives.** E. MAURIN. *Bull. sci. pharmacol.* 30, 337-41(1923).—Samples of rhubarb from China, European countries and the U. S., also the official tincture and ext. were analyzed for anthraquinone. Five samples of Asiatic rhubarbs contained from 3.05 to 4.5% of anthraquinones, 4 European samples 2.4 to 3.5%. From the low content of the official preps. in anthraquinones it was advised to use the powdered root.

L. W. RIGGS

**Commercial varieties of cacao.** RAOUL LECOQ. *Bull. sci. pharmacol.* 30, 341-52(1923).—The principal characters and com. importance of cacaos from N. and S. America, West Indies, Africa, Asia and Oceania are described. Twelve samples of cacao beans representing widely distributed sources were subjected to phys. examn. in which the av. wts., dimensions, percentage of germ, kernel and shell, and percentage of  $H_2O$  in the entire bean and in the shell were detd. Chem. analysis of the 12 samples gave  $H_2O$  4.6-7.61%, ash 2.42-3.90, fat 50.1-53.56, org. matter 36.1-42.19, alky. of ash as  $K_2CO_3$  0.96-1.67, acidity of the fat as oleic acid 1.28-2.64.

L. W. RIGGS

**Certain bases of the tropacocaine type derived from pseudopelletierine.** GEORGES TANRET. *Compt. rend.* 176, 1659-62(1923).—The bases prepd. were: (1) *benzoylmethylgranatoline*  $CH_3N:C_7H_{11}:CH.OCO.C_6H_5$ , obtained by benzylation of *n*-methylgranatoline (pseudopelletierine), a nearly colorless oily liquid, insol. in  $H_2O$ , distills without decompn. at  $230^\circ$  under 24 mm. Hg. It yields definite salts. The relative toxicities of the hydrochlorides of cocaine, benzoylmethylgranatoline and tropacocaine with guinea pigs are 1:0.5:0.33 and with mice 1:0.75:0.2. (2) *Cinnamylmethylgranatoline*, obtained from methylgranatoline and cinnamyl chloride, cryst., m.  $62-63^\circ$ , forms cryst. salts. Its anesthetic properties are inferior to those of the benzoyl deriv. (3) *p*-Nitrobenzoylmethylgranatoline,  $CH_3N:C_7H_{11}:CH.O.CO.C_6H_4NO_2$ , obtained from methylgranatoline and *p*-nitrobenzoyl chloride; pale yellow cryst., m.  $149-150^\circ$ . Its hydrochloride forms white needles sol. at  $15^\circ$  in 46 parts  $H_2O$ . (4) *p*-Aminobenzoylmethylgranatoline, obtained by reduction of the nitro compd. (3) by means of AcOH and Fe filings; white cryst., m.  $194-195^\circ$ . Its hydrochloride is sol. at  $15^\circ$  in 35 parts  $H_2O$ . Its anesthetic power is less than that of the compds. already considered. This study shows that the double piperidinic nucleus with  $C_6$  of homotropacocaine leads to derivs. more strongly anesthetic (and toxic) than the piperidono-pyrrolidinic nucleus with  $C_7$  of tropacocaine.

L. W. RIGGS

**The identification of some local anesthetics.** L. E. WARREN. *J. Am. Pharm. Assoc.* 12, 512-23(1923).—The pptn. tests were made by adding a few drops of the reagent to 1 cc. of a 2%  $H_2O$  soln. of the substance and waiting 10 min. for pptn. or crystn. to take place. Substances scantily sol. in  $H_2O$  were acidified with HCl. The findings from over 400 tests with 30 reagents are tabulated. The substances tested were alypine, apothesine, benzocaine,  $\beta$ -eucaine, butyn, cocaine-HCl, orthoform, phenacaine, procaine, propaesin, quinine and urea-HCl, stovaine and tropacocaine-HCl. A few tests were made on saligenin. A system for the rapid identification of any one of these substances consists in applying the diazo reaction, which seps. the substances into 2 groups. Benzocaine, butyn, orthoform, phenacaine, procaine and propaesin respond. The others do not. This comprises the "diazo grouping." By testing portions of the soln., resp., with KCNS, KI,  $Na_2Fe(CN)_6$ ,  $KNaC_2H_3O_6$ ,  $K_2C_4H_7O_6$ ,  $KMnO_4$ , and  $HgCl_2$  and comparing the results obtained with W.'s tabulations the identity of the local anesthetic may be seen at a glance, since no two of the substances tested give parallel reactions. The following tests are characteristic or nearly so. Alypine gives a violet, cryst. ppt. with  $KMnO_4$  which is less stable than the ppts. from cocaine or tropacocaine and differs in form from those ppts. Apothesine gives a salmon-colored ppt. with  $Na_2Fe(CN)_6$ . With Marquis' reagent a brownish rose color slowly develops, which becomes an intense mahogany-brown. Benzocaine gives beautiful, iridescent crystals with I + KI soln. on standing. With  $HgCl_2$  it forms long, slender, colorless needles on standing. Cocaine gives violet, rhomboidal plates with  $KMnO_4$ , which

frequently have an indentation at one corner. It is optically active.  $\beta$ -Eucaine is not pptd. by any of the identification reagents except  $\text{KMnO}_4$ . The ppt. is less stable than those from cocaine or tropacocaine. Butyn gives a curdy, white ppt. with  $\text{KI}$ . Orthoform is not pptd. by picric acid. It gives an intense black color with  $\text{HNO}_3$ . Phenacaine gives white rosetts with  $\text{KCNS}$ . It does not give a ppt. with  $\text{KNaC}_2\text{H}_3\text{O}_4$  as do other members of the diazo group. Procaine is not pptd. by  $\text{K}_2\text{C}_2\text{H}_3\text{O}_4$  as are the other members of the diazo group. Propaesin gives a ppt. with  $\text{KNaC}_2\text{H}_3\text{O}_4$  but not with  $\text{HgCl}_2$ . Quinine and urea-HCl is levorotatory, the  $[\alpha]_D$  being about  $-173.7^\circ$  at  $21^\circ$ . Saligenin is pptd. by  $\text{Br}$  soln. It is colored rose-red by  $\text{H}_2\text{SO}_4$ . Tropacocaine gives white, glistening scales with  $\text{KI}$ . No characteristic single test was observed for stovaine, although it may be identified readily from the table for rapid identification.

L. E. WARREN

Influence of solar radiations on the development of belladonna and on its alkaloidal content (DELUARD) 11D.

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**Synthetic drugs.** SOC. CHIMIQUE DES USINES DU RHÔNE. Brit. 190,123, Nov. 16, 1922. Ca acetylsalicylate is prepd. by neutralizing the free acid with  $\text{Ca}(\text{OH})_2$  in the presence of  $\text{NaCl}$  soln., the Ca salt sepg. out.

**Synthetic drugs.** E. LAYRAUD. Brit. 191,008, Nov. 29, 1922. Unsymmetrical dialkylbarbituric acids are obtained either by alkylation of monoalkylbarbituric acids or by condensing urea, or substances yielding urea, with unsymmetrical dialkylmalonic acid derivs. (esters, chlorides, amides, etc.) or unsymmetrical dialkylethanoacetic esters, in the presence of Na ethylate or other condensing agent. The acids and also C:C-disubstituted barbituric acids in general may be converted into salts with alkalies or org. bases, particularly piperazine. E. g., ethylbarbituric acid is converted into its Ag compd. by treatment with ammoniacal  $\text{AgNO}_3$  and alkylated with isobutyl iodide and alc., or isoamyl iodide and alc.

A compound of isopropylallylbarbituric acid. E. PREISWERR. Can. 232,254, June 26, 1923. A compd. having a greater analgesic action than a pure pyrazolone deriv. is made by heating isopropylallylbarbituric acid and 1-phenyl-2,3-dimethyl-4-dimethylamine-5-pyrazolone to  $100-20^\circ$ . The product has a yellow color and m.  $92-3^\circ$ .

**Active principle of suprarenal gland.** K. WOYENAKA. U. S. 1,460,832, July 3. The crude active principle of the suprarenal gland is purified by dissolving it in an excess of acid, e. g.,  $\text{HOAc}$ , and pptg. impurities from the soln. with alc. Before sepn. of the active principle from the glands, the latter are treated with pepsin or other proteolytic enzyme.

**Dentifrice.** W. M. RUTHRAUFF. U. S. 1,460,179, June 26. A proteolytic dentifrice is formed with a sufficient amt. of lactic acid to maintain the enzyme and with an abrasive which is inert to the lactic acid, e. g., talc, together with flavoring substances.

**Purifying and packaging ether.** E. MALLINCKRODT, JR. U. S. 1,461,539, July 10. Ether containers to be filled are freed from air *in vacuo* and the air is replaced by N or other gas free from O. All air is removed from the ether and the containers are then filled with the air-free ether and closed and sealed in the O-free gas.

**Fly poison.** HIROSHI TODA. Japan. 41,563, Jan. 28, 1922. A mixt. of hexamethylenetetramine 70, cane sugar 380 or saccharin 1, glycerol 20, glacial acetic acid 10, and  $H_2O$  1,000 parts kills flies or small insects within a few hrs.

## 18—ACIDS, ALKALIES, SALTS AND SUNDRIES

FRED C. ZEISBERG

**Formation of nitric acid in the manufacture of liquid carbon dioxide.** L. HACK-SPILL AND A. COUDER. *Compt. rend.* 176, 1811-13(1923).—Coke by reason of its  $N_2$  content, when burned to obtain  $CO_2$  for liquefying, gives rise to oxides of N, which are fixed as nitrite in the alk. wash, and are partially reliberated by the incoming  $CO_2$ . Ultimately, through oxidation and  $H_2O$ , they give rise to corrosion in app. of the industry. Evidence is presented for these statements.

**The viscosities of mixtures of sulfuric acid and water.** F. H. RHODES AND C. B. BARBOUR. *Ind. Eng. Chem.* 15, 850-1(1923).—The range 0% to 100%  $H_2SO_4$  is covered at 0°, 25°, 50° and 75°.

**The efficient recovery of nitrates from caliche.** J. W. TURRENTINE. *Ind. Eng. Chem.* 15, 853-5(1923).—Suggested remedies for the Chilean nitrate situation include as the principal one the adoption of modern chemical engineering methods at the nitrate factories. Methods developed in the recovery of K from kelp should be almost directly applicable.

**New processes and ideas for the synthetic production of ammonia.** A. SANDER. *Z. kompr. u. fl. Gase* 22, 1-3, 29-32, 41-3; *Chem. Zentr.* 1922, IV, 307.—A crit. review of the Claude, Maxted, Haber, de Jahn and Casale processes.

**Synthesis of ammonia from its elements in the low-voltage arc.** H. H. STORCH AND A. R. OLSON. *J. Am. Chem. Soc.* 45, 1605-14(1923).—The earlier work of Andersen (cf. *C. A.* 16, 3258) was found to be inaccurate in consequence of neglect of a fatigue factor. The app. of Andersen has been improved to overcome this defect; it consists of a Hg anode and a heated cathode filament in an evacuated tube. The variation in the rate of reaction at a const. tube current with the accelerating voltage is such as to give a series of abrupt increases.  $NH_3$  is not formed unless an arc is present. The rate depends upon the diam. of the cathode filament; it is greater for smaller sizes. A series of expts. was made using a Cu gauze anode.

**Recommended specification for quicklime for use in causticizing.** ANON. Bur. of Standards, *Circ.* 143, 5 pp.(1923).—A brief description of the way in which lime is used in causticizing is followed by a general statement as to the quality of lime required. The standard of quality for lime for this purpose is set at 85% available lime. Any product contg. less than 70% available lime or more than 3%  $MgO$  is uneconomical to use. Complete directions for sampling, testing, and retesting are included.

**The preparation of concentrated sodium hypochlorite solutions of great solubility.** H. F. ZOLLER. *Ind. Eng. Chem.* 15, 845-7(1923).—Strong  $NaClO$  solns. can be made commercially by the direct chlorination of buffered  $NaOH$  solns. The buffer material may be Na carbonate, phosphate, tetraborate, or silicate;  $Na_2CO_3$  is the cheapest and is recommended at 2.5% actual concn. The finished chlorinated soln. should react with a blue flash of color to alc. thymolphthalein and purple to phenolphthalein for max. stability. It will bear transportation and will remain permanent for 6 months or longer. It is recommended for disinfection in food factories.

**Substitution factors for dissimilarly saturated solutions of potassium chloride and sodium chloride.** EBERHARD KAYSER. *Kali* 17, 1-9, 37-42(1923).—K. has collected the data influencing the deposition of salts particularly with reference to replacement factors for solns. of  $KCl$  and  $NaCl$  in water where only one constituent is present in sufficient amt. to sat. the soln. These factors refer to the number of parts ( $m$ ) of one salt that may replace 1 part of another salt in such a soln. With rising temp. the replacement factor  $mNaCl$  slowly becomes smaller, the replacement factor  $mKCl$  slowly greater. The change is slight. With  $MgCl_2$  the factors, especially  $mKCl$ , become greater. The substitution factors were used to investigate the character and degree of satn. of the liquors, for the computation of mixed solns. and degree of salting out and for the detn. of soln. changes in countercurrent app.

**The industrial manufacture of copper sulfate by direct methods.** J. ESTALELLA. *Anales soc. españ. fis. quim.* 21, 265-9(1923).—A discussion of methods. It is urged that an investigation be made of the possibility of making the salt on a com. scale by trickling a weak soln. of it down a tower filled with Cu scrap through which a mixt. of  $SO_2$  and air is forced.



**Salt peter in Mexico.** J. PH. BAERTSCH. *Chem.-Ztg.* 47, 465-6(1923).—Natural sodas contain as much as 1.5% salt peter, which can be extd. commercially only in times of emergency. In spite of diligent search throughout Mexico during the war no noteworthy deposits of salt peter were found, but there were discovered extensive deposits of volcanic ash contg. 1.5-6.5% salt peter (including Ca and NH<sub>4</sub> nitrates), evidently originating from supernatant plant deposits. In Guanajuato, Queretaro, Michoacan and San Luis Potosi there were discovered pockets contg. upwards of 20 tons of earth and running as high as 60% of nitrates, chiefly KNO<sub>3</sub>. Such caves have been worked by the natives by a primitive leaching with hot H<sub>2</sub>O, and treatment of the soln. with ashes from the agava plant. The resulting soln. was then evapd. and allowed to crystallize. The extn. of nitrates commercially from Mexican sources is not feasible during normal times.

W. C. EBAUGH

**The ash of the hull of the almond as an industrial product.** A. DE DOMINICIS. *Ann. scuola agr. Portici* (2), 15, 1-11(1920).—A sample of com. ash analyzed: sand and C 3.06, Fe<sub>2</sub>O<sub>3</sub> 2.03, CaO 16.24, MgO 3.29, K<sub>2</sub>O 42.71, Na<sub>2</sub>O 2.73, P<sub>2</sub>O<sub>5</sub> 3.15, SO<sub>2</sub> 1.16, CO<sub>2</sub> 23.90, SiO<sub>2</sub> 1.27 and Cl 0.14%. The ash is deliquescent. It is shipped to soap factories. Samples of hulls were obtained from 14 varieties of almonds and samples of shells from 2 varieties. The % of hull varied from 29 to 47, % H<sub>2</sub>O in the hull 14.49-25.85, ash in dry hull 7.35-12.80, K<sub>2</sub>O in ash 43.76-56.75, Na<sub>2</sub>O 2.04-7.32%. Analysis of the shells gave resp. H<sub>2</sub>O 13.68, 13.13, ash in dry shell 0.58, 0.45, K<sub>2</sub>O in ash 39.15, 30.79, and Na<sub>2</sub>O 2.25, 5.34%.

ALBERT R. MERZ

**Fixation of atmospheric nitrogen by the cyanide process.** KIYOMATSU TERADA. *Bull. Inst. Phys. Chem. Research* (Japan) 2, 234-42(1923).—For conducting the fixation of atm. N<sub>2</sub> by the cyanide process at low temp., T. used a mixt. of Na<sub>2</sub>CO<sub>3</sub> 100, K<sub>2</sub>CO<sub>3</sub> 100, C 220 and Fe<sub>2</sub>O<sub>3</sub> 220 parts as a catalyzer. The reaction takes place at 600°. At 700°, the yield of the cyanide is about 80% and at 750° above 85%. The velocity of passing N<sub>2</sub> was 4.5-5 l. per min. and the reaction was almost completed by 60 min. An iron tube was used for container of the catalyzer and it was little affected owing to low temp.; the vaporization of alkali was almost not perceived. K. KASHIMA

**Nitrogen industry.** ANON. *Rept. Brit. Assoc. Adv. Sci.* 1922, 415-23.—Abstracts of discussions by J. A. Harker on the post-war progress on the fixation of N, J. H. West on the manuf. of H and N and C. J. Goodwin on the Häusser process of N fixation.

C. J. WEST

**The production of hydrogen from water gas.** N. CARO. *Z. kompr. u. fl. Gase* 22, 77-80; *Chem. Zentr.* 1922, IV, 623.—Water gas obtained by the action of steam on red-hot coke (50% H, 40% CO, 5% CO<sub>2</sub>, 4.5% N, 0.5% O) is freed of undesirable gases by liquefaction and 1 m<sup>3</sup>. of pure H recovered from 2.3 m<sup>3</sup>. of H<sub>2</sub>O-gas. The technical process is described and illustrated.

C. C. DAVIS

**Liquid oxygen in technical work.** R. LEPSIUS. *Z. kompr. u. fl. Gase* 22, 80-7; *Chem. Zentr.* 1922, IV, 617; cf. C. A. 16, 832.—The uses of liquid air and liquid O as safe explosives in mining, for filling O app. in mining, for high flying and for autogenous cutting and welding are described. Liquids obtained from Linde machines can be transported in light, thin-walled vessels and the use of heavy steel flasks avoided. C. C. D.

**Spectral indications of the source of oxygen.** PHILIPP SIEDLER. *Z. kompr. u. fl. Gase* 22, 74-7; *Chem. Zentr.*, 1922, IV, 609.—Spectral analysis is suitable as a criterion for ascertaining whether O has been prepd. by rectification, by chem. means or by electrolysis. O prepd. by rectification contains a relatively high % of A, whereas O prepd. by electrolysis or by chem. means is very low in A. A method based on the distinguishing of the A spectral lines is described in detail and illustrated. C. C. D.

**Industrial oxygen.** T. C. FINLAYSON. *Gas World* 78, 520-2(1923); *Chem. Trade J.* 72, 727-9; *Gas J.* 162, 737-41.—A survey of the O processes has been made and a no. of them have been examd. in an exptl. way. Conclusion: No process has been devised which will produce O at a price not exceeding 1 s. per 1000 cu. ft. at a low capital cost. The most promising process is the pressure fractionation process, a soln. process whereby air is compressed in a vessel holding mineral oil as the solvent to 135 lb. and then satd. at 150 lb. pressure by a gas, produced later in the process, contg. 22% O. The pressure is then reduced by stages down to 1 lb. abs. whereby a gas is evolved having a mean compn. of 40% O. The main cost of the process lies in the compression of the air. There is no advantage in fractionating at low temps. The process is most efficient when supplying O of 40% strength. For gas-making purposes the installation of an O plant on these lines would not be an economic proposition. The gas maker could not afford to pay more than 8.5 d. per 1000 cu. ft. of O. J. L. WILBY

**The uses of carbon dioxide.** C. L. JONES. *Can. Chem. Met.* 7, 172-4; *Chem. Met. Eng.* 29, 103-5(1923).—This first instalment contains a good chart of the uses of

CO<sub>2</sub>. Most of the CO<sub>2</sub> of commerce is manufactured by the burning of coke under boilers, absorbing the CO<sub>2</sub> in alkaline carbonate soln. and boiling it out of the latter. The use of CO<sub>2</sub> in the food industry, and in refrigeration and other low-temperature work is described.

**The development of the industry for liquefying and resolving air.** F. POLLITZER. *Z. kompr. u. fl. Gase* 22, 70-4; *Chem. Zentr.* 1922, 617.—A historical survey, from the liquefaction of air to the production of liquid O, N, A, Ne and He. C. C. DAVIS

**The preparation of shoe pastes.** ALDO BOLIS. *L'ind. saponiera* 20, 406, 428; 21, 24-5, 45, 145, 146; *Chem. Zentr.* 1922, IV, 252-3.—Directions are given for the prepn. of wax and fatty pastes contg. oil of turpentine, for those contg. H<sub>2</sub>O and for sapon. pastes. C. C. DAVIS

Volatilization; Pb oxide (Brit. pat. 190,157) 13.

ANDRÉ, LOUIS EDGAR: **Moderne Schuhcremes und Lederputzmittel.** 3rd Ed. Vienna and Leipzig: H. Hartleben. 242 pp.

WEBB, H. W.: **Absorption of Nitrous Gases.** London: Edward Arnold & Co. 25s. Reviewed in *Engineering* 115, 802(1923).

**Synthesis of ammonia.** G. CLAUDE. Can. 232,758, July 17, 1923. The gaseous mixt. is conveyed prior to reaction in indirect contact with the reacting gases in the catalyst chamber, heat is transferred from the catalyst chamber to the gas mixt. prior to its contact with the catalyst and the mixt. is caused to follow a path through the catalyst which insures uniform heating. App. is specified. Cf. C. A. 16, 4302.

**Synthetic manufacture of ammonia.** G. CLAUDE. Can. 232,759, July 17, 1923. The gas mixt. is conveyed in indirect contact with the reacting gases in the catalyzing chamber so that the mixt. is delivered at the lowest temp. commensurate with the maintenance of the reaction, the additional heat being supplied by heat interchange between the gaseous mixt. after reaction and the entering gases before indirect contact with the catalyst, the heat exchange being effected by conveying the gases through and in indirect contact with water. Cf. C. A. 16, 4302.

**Apparatus for the synthesis of ammonia.** G. CLAUDE. Can. 232,760, July 17, 1923.

**Barium hydroxide from barium carbonate.** R. W. SHAFOR. U. S. 1,460,180, June 26. A BaCO<sub>3</sub> residue, such as that obtained by decomp. Ba saccharate with CO<sub>2</sub>, is treated with HCl to form BaCl<sub>2</sub>, and an excess of NaOH is added to ppt. Ba(OH)<sub>2</sub> and form a NaCl soln. contg. a small amt. of Ba salts. The mixt. is cooled and the sepd. Ba(OH)<sub>2</sub> ppt. is removed. NaOH is added to the NaCl soln. to keep impurities in soln. and it is concd. to produce a mother liquor contg. NaCl crystals in suspension, NaOH and a small amt. of dissolved NaCl and Ba salts. The NaCl crystals are sepd. and the remaining liquor is used in the Ba(OH)<sub>2</sub> pptn. The NaCl is dissolved and electrolyzed to form NaOH and Cl and H and the latter are combined to form HCl for continuing the process.

**Alkali cyanides.** F. VON BICHOWSKY. Brit. 190,390, Feb. 22, 1922. A carbide is fused with a nitride or cyanonitride, and an alkali metal compd. which may be an oxide, hydroxide, carbonate or halogen compd. Suitable mixts. are Ti<sub>3</sub>N<sub>4</sub>, CaC<sub>2</sub> and Na<sub>2</sub>CO<sub>3</sub>, and Si<sub>3</sub>N<sub>4</sub>, contg. metallic Fe, carborundum powder, some NaCl, in the form of briquets. The NaCN is sepd. from the reaction product by leaching.

**Cyanogen recovery process.** F. W. SPERR, JR. Can. 232,600, July 10, 1923. Na<sub>2</sub>FeFe(CN)<sub>6</sub> is suspended in a soln. of Na<sub>2</sub>CO<sub>3</sub> and brought into contact with a gas contg. H<sub>2</sub>S and HCN. The Na<sub>2</sub>Fe(CN)<sub>6</sub> formed is decomposed with NaHSO<sub>4</sub> to liberate HCN and form Na<sub>2</sub>FeFe(CN)<sub>6</sub> for reuse. The Na<sub>2</sub>SO<sub>4</sub> formed may be converted to Na<sub>2</sub>CO<sub>3</sub> for further use in the process by the LeBlanc process.

**Chlorides.** B. H. JACOBSON. Brit. 190,688, Aug. 30, 1922. Addn. to 181,385 (C. A. 16, 3735). Al, Sb, As, Fe, Sn, Zn and other chlorides; double chlorides. In the production of anhyd. chlorides by the reaction of Cl on a metal in the presence of Br, as described in the principal patent, a salt such as Na or K chloride or bromide is added so as to maintain the product liquid without necessitating a high temp. or pressure. When a bromide is used it is not necessary to add free Br. The invention is described with reference to AlCl<sub>3</sub>. In an example, AlCl<sub>3</sub> and NaCl are melted in a covered Fe pot or rotating ball mill and Al and Br are then added, the temp. being suitably 125-50°. From time to time portions of the melt are drawn off, and more Al and salt are added and, when necessary, some additional Br. The product withdrawn may contain 5-30% of NaCl, but is suitable for use in the Friedel-Crafts reaction. If

the temp. is maintained at 200°,  $\text{AlCl}_3$  alone is volatilized and is recovered in a condenser.

**Sulfur chloride.** E. LEGBLER. Brit. 190,995, Aug. 4, 1922.  $\text{S}_2\text{Cl}_2$  of correct b. p. is produced continuously by passing Cl into molten S *in vacuo*, and condensing the distillate. S is added periodically and the quantity of Cl and the vacuum are regulated so as to give a light yellow product. A Cl carrier such as Fe, I or Fe chloride may be employed.

**Sodium sulfites.** V. DREWSSEN. Can. 232,993, July 24, 1923. Milk of magnesia liquor is agitated in absorption tanks through which  $\text{SO}_2$  gases are passed in opposite direction to form Mg bisulfite which soln. is reacted upon with NaCl to form and ppt.  $\text{NaHSO}_3$ .

**Lead monoxide.** G. V. BARTON AND LEAD PRODUCTS SYNDICATE, LTD. Brit. 190,733, June 22, 1921. App. for the production of  $\text{PbO}$ , by the method in which a bath of molten Pb is agitated and oxidized with a blast of air or steam and the oxide fumes are condensed in suitable chambers, comprises an oxide pot which may be of any suitable construction, and which is heated by the furnace, the gases from which, together with those from the melting-pot furnace (not shown), pass into the main flue.

**Lead monoxide.** G. V. BARTON AND LEAD PRODUCTS SYNDICATE, LTD. Brit. 190,955, June 22, 1921. Improvements in the manuf. of  $\text{PbO}$ , by the method in which a bath of molten Pb is agitated and oxidized with a blast of air or steam and the oxide fumes condensed, consist in connecting the oxide-pot to the depositing chamber by a straight but steeply inclined shaft, and in reducing the power required to drive the rotary beaters. Cf. 13,451, 1908, 13,600, 1910 and 190,733 (preceding pat.).

**Drying tungsten oxide.** BRITISH THOMSON-HOUSTON CO., LTD. Brit. 190,237, Sept. 14, 1921. A W oxide is prepd. in a dried and powd. condition by providing a supply of the washed ppt. mixed with liquid of a neutral character to form a thin paste, depositing the paste upon a heating surface in a thin layer, and removing the dried layer from the surface so as to break up the layer into a powder. A suitable construction is specified.

**Zirconium oxide.** M. N. RICH. U. S. 1,460,766, July 3. A slightly acid soln. of normal Zr sulfate, free from substantial amts. of sulfates of alkali metals or alk. earth metals, is allowed to stand for 4 days with frequent agitation and the basic Zr sulfate deposited is sepd. from the soln. and washed, dried and heated to produce  $\text{ZrO}_2$ .

**Hydrogen sulfide.** KOPPERS CO. Brit. 190,118, Oct. 3, 1922. Gases contg.  $\text{H}_2\text{S}$  are scrubbed with an absorbent liquid to remove the  $\text{H}_2\text{S}$  and the latter is recovered in concd. form and the absorbent liquor regenerated by heating the satd. liquor. The process is particularly suitable for the treatment of gases contg. little  $\text{CO}_2$ , e. g., the gases obtained by the cracking of petroleum. Gases such as coke oven gases may be treated provided their content of  $\text{CO}_2$  has been reduced. For scrubbing the gases there may be employed an aq. suspension of a compd. of Mg, Ca, Ba, or Sr which will react with  $\text{H}_2\text{S}$ . A suspension of Mg oxide, hydroxide, carbonate, or basic carbonate in an alkali soln. may also be used. A suitable app. is specified.

**Recovery of hydrogen sulfide.** F. W. SPERR, JR. Can. 232,598, July 10, 1923. A gas contg.  $\text{H}_2\text{S}$  is passed into contact with a suspension of  $\text{Mg}(\text{OH})_2$  to absorb the  $\text{H}_2\text{S}$ . The suspension contg. the  $\text{H}_2\text{S}$  is preheated, then further treated to expel the  $\text{H}_2\text{S}$  and to regenerate the suspension, the liberated vapors being used to preheat the suspension.

**Recovery of hydrogen sulfide.** F. W. SPERR, JR. Can. 232,599, July 10, 1923. Gases contg.  $\text{H}_2\text{S}$  are passed into contact with a suspension of  $\text{Ca}(\text{OH})_2$  and  $\text{CaS}$ , to absorb the  $\text{H}_2\text{S}$ . The suspension is preheated by the liberated gas, then further heated to expel the  $\text{H}_2\text{S}$  and to regenerate the suspension.

**Hydrogen sulfide.** F. W. SPERR, JR. Can. 232,601, July 10, 1923. A gas contg.  $\text{H}_2\text{S}$  is passed through a  $\text{Na}_2\text{S}$  soln. to absorb the  $\text{H}_2\text{S}$  from the gas; the preheated soln. is further heated to liberate the  $\text{H}_2\text{S}$  and to regenerate the soln. The soln. is preheated by passing it in countercurrent with the liberated  $\text{H}_2\text{S}$  and the regenerated soln.; the latter is cooled and passed back to the gas treatment stage.

**Recovery of hydrogen sulfide.** R. E. HALL. Can. 232,602, July 10, 1923. Gas contg.  $\text{H}_2\text{S}$  is passed into contact with a soln. of  $\text{Na}_2\text{CO}_3$  contg. in suspension  $\text{Mg}(\text{OH})_2$ , the  $\text{Na}_2\text{CO}_3$  acting as a carrier for the absorption of  $\text{H}_2\text{S}$  by the  $\text{Mg}(\text{OH})_2$  in suspension. The soln.-suspension contg.  $\text{H}_2\text{S}$  is first preheated by the liberated vapors, then further heated to expel the  $\text{H}_2\text{S}$  and to regenerate the soln.-suspension.

**Sulfur burning furnace.** A. T. PRENTICE. Can. 232,558, July 10, 1923.

**Condensation product of urea with formaldehyde.** K. RIPPER. U. S. 1,460,606, July 3.  $\text{NaOAc}$ , Na borate or other salts giving an alk. reaction on hydrolysis are

added to retard gelatinization of the initial condensation products sol. in  $H_2O$  obtained from urea and  $CH_3O$ .

**Phenolic condensation products.** D. S. KENDALL. Can. 232,251, June 26, 1923. Phenol and AcH are heated in the presence of a small percentage of  $H_2SO_4$  until a permanently fusible sol. resin is formed and the acid is neutralized and removed.  $(CH_3)_2N$ , may be added to the resin. Cf. C. A. 16, 2761.

**Waterproofing composition.** G. W. KRAMER. U. S. 1,460,251, June 26. A waterproofing compn. adapted for use on paper, brick, cement, plaster or wood is formed of paraffin wax, Al oleate and turpentine or other thinner.

**Marking ink; waterproofing materials.** J. H. M. DE BRETTON. Brit. 190,232, Sept. 13, 1921. The soln. obtained by soaking the crushed fruit of *Semecarpus ana-cardium* in a spirituous liquid such as methylated spirit, gasoline, benzene, naphtha, ether, EtOH, or  $CCl_4$ , is treated with alkali, such as powd.  $Na_2CO_3$ , to neutralize free acid. The ext. so obtained may be used as a marking ink, when it is applied in the usual way, and the mark touched with dry  $Na_2CO_3$  or with a dil. soln. of the alkali. The ext. may be incorporated with a suitable base such as beeswax for use as a *leather dressing* or *polish*, or may be used as a waterproofing agent or dye.

**Detergent liquid.** F. A. WRIGHT. U. S. 1,461,170, July 10. A mixt. adapted for impregnating dust cloths is formed of crude oil 1 gal., gasoline  $1\frac{1}{2}$  gal., raw linseed oil 4 oz. and 2 drops oil of cassia for each 4 sq. ft. of cloth to be impregnated.

**Detergent.** C. A. R. SAMSOE. U. S. 1,460,039, June 26. A pasty mixt. for cleaning metal, bone, enamel or other surfaces is formed of  $NaHCO_3$  and glycerol in proportions to make a pasty mixt.

**Adhesive.** O. JOHNSON. U. S. 1,460,757, July 3. An adhesive which is waterproof is formed of the tacky substance of soy bean,  $Ca(OH)_2$  and NaF.

**Shoe dressing.** S. CASSISSA. U. S. 1,461,696, July 10. Plaster of Paris 40, borax 5, magnesia 20, sugar 5, starch 25 and glycerol 5 parts, are mixed with  $H_2O$  to form a paste.

**Brake-lining dressing.** W. B. FALOR. U. S. 1,461,386, July 10. A dressing suitable for use on the linings of clutch facings or brakes is formed of "600 W" petroleum oil 2 gals., resin 1 lb. and fuller's earth 12 oz.

**Brakes; friction clutches and gears.** H. FROOD. Brit. 191,088, July 1, 1921. The friction members of brakes, friction clutches and gears comprise materials of woven fibers into which the cementitious binder is incorporated by "frictioning." The binders described in 4,627, 1909 (C. A. 5, 161) and 164,772 (C. A. 16, 471), or phenol-aldehyde condensation products, or a mixt. of dammar gum, rubber, and linseed or tung oil with or without glue or casein, or a mixt. of glue or casein and rubber, or chloronaphthalene substitution products, or Na or K silicates may be used to impregnate the fabric.

**Fabrics for brakes, clutches, floor coverings, etc.** H. FROOD. Brit. 191,089, July 1, 1921. A mixt. of dammar gum and rubber, preferably in the proportions of 2 to 1 resp., is used to impregnate fibrous materials to form brake blocks and linings, friction members for clutches and friction gearing, stair treads, floor coverings, mats, etc., and soles and heels of boots, etc. Other binding agents may be added to the dammar gum and rubber, e. g., those described in 4,627, 1909 (C. A. 5, 161) and 164,772 (C. A. 16, 471), phenol-aldehyde condensation products, glue, casein, chloronaphthalene substitution products, and Na or K silicate. Solvents such as linseed or tung oil with driers, or naphtha, benzene, etc. are used. The binder may be incorporated in the fabric by "frictioning," or by the usual methods, and the fabric subsequently air-dried and stored. Cf. 17,253, 1900.

**Marking lenses.** E. D. TILLYER and J. F. WIXTED. U. S. 1,461,074, July 10. Ophthalmic lenses are marked with phosphoric acid or other substance which produces normally invisible markings which become visible when moistened. These markings (e. g., trade marks) may be retained in visible state by moistening and applying oil to retain the moisture.

**Diaphragm for sound-reproducing apparatus.** J. A. STEURER. U. S. 1,459,803, June 26. A disc of soft Fe or steel or other non-absorbent material is provided with a concentric coating of dried phenolic condensation product, applied as a soln. in a volatile solvent and then dried.

## 19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

**Chemical glass and hard glass.** AD. LECRENIER. *Bull. federation ind. chim. Belgique* 1922, 225-34; *Chem. Zentr.* 1922, IV, 30.—Besides numerous data on the glass works of the Val St. Lambert, the formation and properties of hard glass are explained, with emphasis on the importance of careful cooling to obtain the lowest possible coeff. of expansion. On cooling the rate of decrease of strain is proportional to the square of the strain. This relation is derived mathematically. From measurements of many types of glass the coeffs. of expansion for the following substances were calcd.:  $\text{SiO}_2$  0.8,  $\text{B}_2\text{O}_3$  0.1,  $\text{PbO}$  3.0,  $\text{MgO}$  0.1,  $\text{Na}_2\text{O}$  10.0,  $\text{K}_2\text{O}$  8.5,  $\text{CaO}$  5. C. C. DAVIS

**The firing of porcelain by means of masut.** ALBERT GRANGER. *Ceramique* 25, 1, 167-70; *Chem. Zentr.* 1922, IV, 489.—Firing with masut is shown to be as economical as firing with wood and is particularly adapted for porcelain difficult to fire and that requiring a high temp. The technic of firing with masut is described. C. C. DAVIS

**Stoneware as material for the construction of apparatus and machines.** C. FRINEL. *Chem. App.* 10, 85-7, 93-5(1923).—A mathematical consideration, with 7 charts and tables, of some of the properties of stoneware, such as flexibility, compressibility, porosity, heat cond., expansion, resistance to internal and external pressure, etc. J. H. MOORE

**Properties and testing of refractories.** R. RIEKE. *Gas u. Wasserfach* 66, 33-6, 53-5, 66-8(1923). J. L. WILEY

**Some interesting properties of refractory materials.** B. BOGITCH. *Rev. universelle mines* 17, 65-80(1923).—A description of the chem. and phys. properties of refractory materials, including their chem. compn. in relation to their fusibility, their phys. properties as a function of temp., and dilatation and heat cond. as a cause of their slow destruction. C. C. DAVIS

**The effect of enamel on the transmission of heat.** A. H. GIBSON, F. C. LEA AND EZER GRIFFITHS. *Repts. Light Alloys Sub. Comm., Advisory Comm. for Aeronautics* No. 5, 61-90(June, 1921); *J. Inst. Metals* 28, 632.—The rate of flow of heat from a rough cast Al surface to the air or to water is considerably improved if the surface is coated with a smooth enamel. A large no. of tests showed that the best results are obtained with a hard, smooth, stoved enamel, which increases the rate of transmission of heat from a rough cast Al alloy surface to air by 15% and to water by 4 to 8% from cast iron to air by 7% and from steel to air by 2%. No effect is produced on Cu. H. G.

BLACKER, J. F.: **The A. B. C. of English Salt-Glaze Stoneware, from Dwight to Doulton.** London: Stanley Paul & Co. 15s. net. Reviewed in *J. Roy. Soc. Arts* 71, 565(1923).

**Glass.** SOC. ANON. QUARTZ ET SILICE. *Brit.* 190,476, Dec. 8, 1922. Fused  $\text{SiO}_2$ , transparent and free from bubbles, is made by agglomerating the raw material, reduced to fine powder, with gelatinous  $\text{SiO}_2$  and then compressing it into molds of the desired shape at a pressure of about 200 kg. per sq. cm. The molded mass is next heated to about  $150^\circ$ , to get rid of moisture, and is then fused in an elec. furnace. Agglomeration of the raw material is facilitated by first transforming it into cristobalite by heating to about  $1500^\circ$ .

**Glass.** SOC. ANON. QUARTZ ET SILICE. *Brit.* 190,477, Dec. 8, 1922. To obtain fused quartz free from bubbles, compact siliceous rocks of a high degree of purity and preferably contg. no micro-cryst. cement, are melted. The rock is cut into cylinders which are perforated axially so that they can be threaded on the C electrode of the furnace.

**Glass.** BRITISH THOMSON-HOUSTON CO., LTD. *Brit.* 189,926, Oct. 6, 1921. Shaped articles, rod, or tube of transparent  $\text{SiO}_2$  are made by fusing the  $\text{SiO}_2$  under atm. pressure, cooling, reheating the  $\text{SiO}_2$  to a plastic state, and then molding to a desired form, or extruding through a die, by applying pressure. The  $\text{SiO}_2$  is first freed from bubbles by melting it *in vacuo* and subjecting it to pressure in the manner described in 188,451. A suitable construction is specified.

**Glazing bricks, etc.** K. FRIEDRICH. *Brit.* 190,267, Sept. 26, 1921. Addn. to 154,236 (cf. C. A. 16, 999). A coating compn. to be applied to concrete, sandstone, clay, brickwork, etc., consists of  $\text{H}_2\text{O}$  and finely sifted cement with a waterproofing

ingredient, such as a bituminous, resinous, or wax-like substance, or a metallic soap. Suitable soaps are obtained by using a mixt. of alk. soap with ammoniacal Zn solns. or ammoniacal or alk. solns. of Cu, Pb, Sn, Cr, or Al hydroxides, or a mixt. of Ca sub-oleate and  $Al_2(SO_4)_3$ .

**Heat-proofing ceramic ware.** SHINTARO NIMURA. Japan. 41,540, Jan. 27, 1922. Clay suspension is boiled under 1-5 mm. pressure to remove gases. After cooling it is gradually poured into gypsum molds without agitation, dried and burned in an oven as usual. The product is compact and extremely heat-resistant. When heated to  $900^\circ$  it is not cracked by dropping  $H_2O$  on it.

**Magnesia refractory.** W. W. GREENWOOD. U. S. 1,461,444, July 10. A refractory material suitable for furnace linings or covering resistance wires is formed of preshrunk  $MgO$  grains united by a ceramic bond (contg. clay and  $CaSO_4$ ) so that the product will withstand drying and firing without detrimental shrinkage.

**Melting vitreous enamels.** F. D. COOK. U. S. 1,460,888, July 3. Enamel is run continuously from a melting chamber as it melts and is continuously withdrawn and quenched under controlled temp. conditions, to prevent loss of opacity.

## 20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

The present status of scientific investigations on cement. C. R. PLATZMANN. *Centr. Bouwbedrijven* 13, 249-52; *Chem. Zentr.* 1922, IV, 427; cf. *Tonind. Ztg.* 46, 214. —Recent investigations on the compn. and hardening of portland cement are reviewed.

C. C. DAVIS

**Cement will solve many Asiatic problems.** P. C. VAN ZANDT. *Concrete* (Mill Section) 23, 9-11(1923).—A list of cement plants in the Orient, their location, capitalization, and capacity is given. The extensive use of cement, the selling price, and the amt. of exports and imports are discussed.

J. C. WITT

**The manufacture of portland cement with the simultaneous recovery of potash.** A. HOLTER. *Zement* 11, 304-5, 313-15, 328-30; *Chem. Zentr.* 1922, IV, 701.—A description with 15 illustrations of the plant of the Dalen portland cement works which produces portland cement from feldspar and limestone, instead of clay, according to the patent of Junner and Krupp, and ppts. the dust by the Cottrel process. A fertilizer contg. 15.5%  $K_2O$  is obtained.

C. C. DAVIS

**Trass and portland cement.** C. R. PLATZMANN. *Centr. Bouwbedrijven* 13, 329-32; *Chem. Zentr.* 1922, IV, 33-4.—Through joint use of suitable volcanic minerals, particularly trass and phonolite, considerable saving can be made in cement without decreasing the strength of the concrete. Because of their volcanic origin, trass and phonolite contain sol.  $SiO_2$ , which according to the theory of Michaelis can combine, during the hardening of concrete, with free  $CaO$ . Complete data are given of strength tests of concrete contg. varying amts. of trass. In general 25-33% by wt. of the cement can be replaced by trass without lowering the strength materially (it is to be noted that 1 m<sup>3</sup>. of cement weighs 1500 kg., but trass only 1000 kg.). Roofing tile of cement often becomes unsightly from the sepn. of  $CaCO_3$  arising from atm.  $CO_2$  and  $Ca(OH)_2$  leached out by rain water. This effect can be prevented by addn. of trass (preferably 1 part cement,  $\frac{1}{3}$  part trass and  $2\frac{1}{2}$  parts gravel). Trass, because of its fineness, improves the texture of concrete, but has not in itself hydraulic properties and therefore cannot replace cement.

C. C. DAVIS

**Investigations of the resistance of mortars made with standard cements to wear (resistance to cracking).** NITZSCHE. *Zement* 11, 315-6; *Chem. Zentr.* 1922, IV, 702; cf. C. A. 16, 2975.—Certain criticisms are answered.

C. C. DAVIS

**The effect of sea water on concrete.** C. R. PLATZMANN. *Centr. Bouwbedrijven* 14, 67-9; *Chem. Zentr.* 1922, IV, 1031.—In general concrete is resistant to sea water if the cement has the following compn. in %:  $SiO_2$  19-25,  $Al_2O_3$  4-9,  $Fe_2O_3$  2-6,  $CaO$  60-5,  $Mg$  1-5,  $SO_3$  1-2. Sea water should not be used in the prepn. of reinforced concrete because of the ready tendency to rust. Particularly important is a sufficient compactness; this can be got by the addn. of trass.

C. C. DAVIS

**The substitution of the clinker in blast-furnace cement by alkali minerals.** RICHARD GRÜN. *Zement* 11, 327-8; *Chem. Zentr.* 1922, IV, 701.—The conclusion of Krebs (cf. C. A. 16, 2974) that hydraulic cements can be prepd. from vitreous basic blast furnace slags by mixing with alkali minerals and gypsum is too general a statement. Some slags possibly have the required properties but expts. by G. show that this is not true in general.

C. C. DAVIS

**Energy of crystallization of calcium sulfate dihydrate, and "regenerated" gypsum.** M. VON GLASENAPP. *Zement* 11, 365-7(1922).—The complete conversion of 2  $\text{CaSO}_4 \cdot \text{H}_2\text{O}$  into the dihydrate requires only a little more than the theoretical amt. of water. In consequence of the increased crystn. pressure the regenerated gypsum has a more flaky structure than the natural mineral and is also notably harder than the latter.

J. S. C. I.

**The heat-insulating power of structural material.** H. BURCHARTZ. *Tomind. Ztg.* 46, 713-4, 721-2; *Chem. Zentr.* 1922, IV, 701.—Expts. were made on sand-lime brick with the heat-insulation tester of Gary-Dittmer. Its high heat-insulation capacity is due to its porosity and quartz content. Sand-lime brick can be ranked with other brick in regard to this property.

C. C. DAVIS

MARCHIARO, CORRADO: *Le fabbriche di calce e cementi*. Nuova edizione stereotipa. Torino: Unione tipografico-editrice. 406 pp. L. 25.

**Artificial stone, cements, etc.** H. BERRY. *Brit.* 189,892, Sept. 13, 1921. Waste slate, coal shale, granite, broken bricks, clinker, slag, or any Al silicate, or sand, quartz, flint, or other form of  $\text{SiO}_2$ , is powd. and mixed with  $\text{MgO}$ , and with either tartaric acid or the carbonates, hydrates, or bicarbonates of Na, K, or  $\text{NH}_4$ , or mixts. of these. 1-2% of sol. silicates may be added to the alk. substances, or the finished product may be soaked in a sol. silicate soln. Traces of Ba or Sr salts, with or without  $\text{NH}_4$  salts such as the chloride, sulfate or phosphate may be added, and an addn. of 1-2% of a sol. Mg salt, preferably the sulfate, may also be made. The magnesite is preferably calcined at 300-600° in an atm. of steam, any distillate being collected and added to the compn. A typical compn. consists of powd. slate 85,  $\text{MgO}$  10,  $\frac{1}{2}$  part of Ba compd. 0.5 and  $\text{NaHCO}_3$  5 parts. The product may be used for flooring or molded articles, or if mixed with asbestos, slag wool, or the like, as an insulating covering. Cf. *C. A.* 17, 2486.

**Concrete.** A. J. MYLERS. *Brit.* 190,849, Oct. 27, 1921. A mixt. of port cement and a light porous aggregate such as sawdust or cork dust, with or without fillers, such as barytes and chalk, and coloring matter, such as oxide of iron, is gaged with a soln. of a sol. salt such as  $\text{CaCl}_2$ . Cf. 180,887.

**Plaster of Paris mixture.** J. N. WIGGIN. U. S. 1,460,396, July 3. Setting of plaster of Paris is controlled by mixing powd. plaster of Paris which is substantially free from  $\text{H}_2\text{O}$  with plaster of Paris having  $\text{H}_2\text{O}$  mixed with it in somewhat less than a sufficient amt. to solidify it.

**Flooring and paving composition.** C. F. CURTIS. U. S. 1,460,643, July 3. Coke breeze, sand and wood dust are mixed in about equal amts. with a smaller amt. of plaster of Paris and a larger amt. of port. cement and with  $\text{H}_2\text{O}$  contg. a small amt. of alum.

**Porous blocks from molten slag or other materials.** M. O. SEM. U. S. 1,458,858, June 12. Building blocks are formed by melting slag (which may contain approx.  $\text{SiO}_2$  50,  $\text{Al}_2\text{O}_3$  15,  $\text{CaO}$  30 and  $\text{MgO}$  5%), agitating the slag and injecting  $\text{H}_2\text{O}$  into it to form a foam, rolling the porous material into sheet form, molding and cooling. The sp. gr. of the molded product may be varied from 0.1 to 1.5 but about 0.5 will be usual. Other melted materials may be similarly treated to obtain a porous product. An app. is described.

**Preserving wood.** N. A. ALEXANDERSON and J. T. OLSSON. *Brit.* 190,074, Apr. 3, 1922. An impregnating agent for wood comprises one or more fluorides or fluosilicates, or both, and one or more phenols or phenol ethers, or both, with or without substances, such as  $\text{FeSO}_4$ , K chromate, or a dichromate in conjunction with an alkali, which prevent corrosion of the app. The mixt. is used in the form of an aq. soln. of 1-1.5% strength. A typical compn. consists of 75 parts of neutral NaF, 25 parts of phenols or phenol ethers of high b. p., and 5 parts of K chromate.

## 21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

**The preparation of fuels of inferior quality for boiler operation.** F. HÄUSSER. *Ber. ges. Kohlentechn.* 1, 119-26; *Chem. Zentr.* 1922, IV, 717-8.—Waste fuels which come from most mines as sludge and coke refuse have properties which supplement one another so that their disadvantages of firing can be overcome by a proper mixt. A mixing app. (built by Schüchtermann and Kremer) is described which is connected with a water-tube boiler plant of 4 boilers, each of 250  $\text{m}^2$  heating surface. The boiler plant

is heated exclusively by a mixt. of waste fuels. The Kosmos mixing app. for the same purpose is also described. C. C. DAVIS

The refining and chemical manufacture of fuel. FRANZ FISCHER. *Ges. Abh. Kenntnis Kohle* 5, 631-6; *Chem. Zentr.* 1922, IV, 1038.—A short description of the refining of peat (drying, low-temp. gasification), brown coals (briquetting, low-temp. gasification, distn.) and anthracites (low-temp. gasification, coking and gas plants) and of oxidation under pressure and the treatment of coal with compressed H.

C. C. DAVIS

The firing of fuels with high ash and water content on under-draft feed. PRADEL. *Die Wärme* 45, 319-22; *Chem. Zentr.* 1922, IV, 660.—A series of boiler tests is described in which fuels of low value were burned on the Pluto grate, a feed grate with controlled under-draft. Limits are detd. for the H<sub>2</sub>O and ash content for a fuel within which it is economical to burn on a feed grate.

C. C. DAVIS

Contributions to the solution of the vaporization of liquid fuels. HANNS ECKART. *Auto-Technik* 11, No. 14-5, 6-15; *Chem. Zentr.* 1922, IV, 648.—The surface tension and viscosity of the liquid play an important part in vaporizing the liquid. These properties were studied for various fuels and the results tabulated.

C. C. DAVIS

The "Rotamisor" liquid fuel burner. ANON. *Petroleum Times* 10, 57-8(1923).—Air and oil are thoroughly mixed and the oil is atomized by a rotating conical device within the burner so that the ignition mixt. burns directly from the tip of the burner. A low air pressure is used.

D. F. BROWN

Recovery of fuel from ashes. H. A. PRAGER. *Chem. Age* (London) 8, 638-40 (1923).—The Ullrich dry magnetic process is described. It is similar to the magnetic process for removing tramp Fe from coal, etc., the clinker contg. the Fe oxides formed during combustion being attracted by the high magnetic field whereas the residual combustible is not attracted at all. About 1.84% of Fe in the ashes, corresponding to a content of about 0.27% in the coal, is adequate. The consumption of direct current by the magnets is 0.7 to 1.0 kw. hr. per ton of ashes. About 90% of the fuel content is recovered. The cost per ton of recovered fuel ranges from about 1s. 10d. to 4s. 6d. depending upon the character and amt. of ashes treated and the requirements for labor.

J. L. WILEY

Scientific utilization of factory refuse. DAVID BROWNLIE. *Chem. Trade J.* 72, 693-4(1923).—Ordinary factory refuse should not be burned under the plant boilers, as such a method reduces their efficiency. There are several types of refuse destructor plants which can be used in conjunction with water heaters or even with water-tube boilers if the amt. of refuse is large. Ordinary factory refuse has a net heating value of about 2000-2500 B. t. u. per lb. and in a combined steam generation and refuse destructor plant, 1 lb. of refuse will evap. to steam 1-1.5 lb. of water. The burning of city refuse is also profitable from a steam-raising standpoint.

J. L. WILEY

Wood fuel. S. SCHOLDSTROM AND L. B. SCHIBBYE. *Svensk Pappers-Tid.* 25, 344-5(1922); cf. *C. A.* 16, 4043; Lindhagen, *C. A.* 16, 4321.—New detns. give: with 12% CO<sub>2</sub> in the smoke from 1 kg. dry wood 1.833 kg. CO<sub>2</sub>, 0.540 kg. H<sub>2</sub>O, 4.613 kg. N<sub>2</sub>, and 3.214 kg. air; with 14% CO<sub>2</sub> in the smoke 1.833 kg. CO<sub>2</sub>, 0.540 kg. H<sub>2</sub>O, 4.613 kg. N<sub>2</sub>, and 1.777 kg. air. The former gives a calcd. max. temp. of 1520°, the latter 1730°, both being smaller than the corresponding temps. detd. by Lindhagen. The av. sp. heat of the gases should be used in the calcn.

W. SGERBLOM

Wood fuel. M. T. LINDHAGEN. *Svensk Pappers Tid.* 26, 8-9(1923); cf. preceding abstr.—L. questions the accuracy of the diagrams of S. and S., their use of the sp. heat of gases, and asserts that they calcd. the CO<sub>2</sub> content on moist gases. Conditions accompanying complete burning of wood cannot all be expressed in curves. W. S.

Wood fuel. S. SCHOLDSTROM AND L. B. SCHIBBYE. *Svensk Pappers Tid.* 26, 120-1(1923); cf. preceding abstr.—Lindhagen's criticism is based on a misunderstanding of the method of drawing the curves. The CO<sub>2</sub> content of smoke gases is calcd. on dry gases. The theory underlying the drawing of the curves is explained and a general formula is developed for the % loss of wood through smoke gases and H<sub>2</sub>O vapor.

W. SGERBLOM

Alcohol fuel mixtures. H. R. ADAM. *J. Chem. Met. Mining Soc. S. Africa* 23, 112-8(1922).—The phys. properties of EtOH affecting its use as a motor fuel are summarized. The most important practical objection to the use of alc. itself as a motor-fuel is the low vapor pressure. Tables and curves show the soly. of gasoline, kerosene, benzene, 90% benzene, and petroleum ether in alc. contg. various amts. of water. The soly. of all gasolines is nearly the same and drops very rapidly as the water in the alc. increases. 100 parts of 94.0% alc. by vol. dissolves 66 parts gasoline, 92.5% alc. 45 parts, 88% alc. 21 parts, 81% alc. 8 parts, 72% alc. 3 parts, and 65% alc. 2 parts.



A change of temp. from 5° to 25° increases the soly. of gasoline in 100 parts of 89% alc. by vol. from 15.5 to 20.7 parts by vol. The use of methyl ether in place of the less sol. acetylene is suggested as a means of increasing the vapor pressure of fuels contg. large proportions of ethyl alc. Two to 2.5% by vol. of methyl ether in 93% alc. raises the vapor pressure to about 130 at 24°, that is to a pressure roughly the same as the vapor pressure of American gasoline.

E. H. LESLIE

Abstracts and quotations from recent scientific literature on subjects of alcohol as a motor fuel. H. ARNSTEIN. *Louisiana Planter* 70, 568-9, 590-1, 608-10; 71, 32-3 (1923).

C. H. CHRISTMAN

Experiments on vehicle motors. I. Crude tar fractions as fuel for vehicle operation. F. HAUSER, R. BESTEHORN AND H. ELLERBUSCH. *Ber. Ges. Kohlentech.* 1, 152-60; *Chem. Zentr.* 1922, IV, 721.—A crude tar benzine ( $d_{15}$  0.850, av. heating value 9682 cal. per kg.) and a crude tar motor oil ( $d_{15}$  0.957, av. heating value 8968) were tested. By the use of crude benzine the inlet valve became covered with a black shiny sticky deposit which ultimately hardened and clogged the valve. This is due to unsatd. hydrocarbons. Crude tar motor oil caused a strongly smoky exhaust. These are not practicable for present day motors.

C. C. DAVIS

Economic motor fuel volatility. S. M. LEE. *J. Soc. Automotive Eng.* 13, 3-15 (1923).—The 4 fuels tested by the Bur. Standards described by R. E. Carlson, were tested under winter conditions and the results are given in the form of numerous tables and graphs. The results do not show large differences in fuel consumption between the light and heavier fuels, although the latter was somewhat greater. The difference is probably due more to the carburetor setting than anything else. Crank-case diln. was greater with the less volatile fuels under all conditions of test. The circulating water temp. had the greatest single influence upon the rate of diln., and the mixt. ratio had considerable effect.

D. F. BROWN

Winter tests show lower mileage with heavy fuels. H. C. DICKINSON AND J. A. C. WARNER. *J. Soc. Automotive Eng.* 13, 87-92(1923); cf. preceding abstr.—Tests on 4 grades of motor fuels under winter conditions by 10 companies covering a total mileage of 50,136 mi. are described. The grand av. mileage of the more volatile fuels exceeds that of the less volatile by about 2.8%. In ton mileage the % is increased to about 3.1. Crank-case diln. increases with decrease in volatility of the fuel. D. F. B.

Effect of compression on detonation and detonation control. H. L. HORNING. *J. Soc. Automotive Eng.* 13, 144-50(1923).—Detonation is thought to be due to the fact that with increasing temp. an increasing frequency of radiant energy impulses is caused and that it finally reaches a point where the frequency corresponds with the crit. rate of the electrons that bind the elements together. Thus it breaks them asunder and then the velocity attains the highest rate possible in a gas of that d. and temp. The 3 factors affecting detonation are the reaction coeff., which is characteristic of the fuel and related entirely to the force diagram in which the electrons of the fuel are arranged; some power of the d. of the fuel in the mixt.; and some power of the abs. temp. Methods of detonation control by use of "anti-knock" substances and engine design are discussed as well as hot spots, cooling difficulties and turbulence as controlling factors for detonation. Actual compression pressures attained in road tests without detonation were a ratio of 5:1 and 104 lb. per sq. in.

D. F. BROWN

One hundred ton miles per gallon. J. B. FISHER. *J. Soc. Automotive Eng.* 13, 139-43(1923).—Details of motor improvements as worked out by the Waukesha Motor Co. relating to vaporization; use of higher water jacket temps. without danger of hot-spots, cutting down losses to cylinder jackets; higher compressions, made possible by better distribution, improved cylinder heads and the use of Al pistons are described. 100 ton miles per gal. are easily obtained with the motor making use of those improvements although this is only 25% of the theoretical power obtainable. D. F. BROWN

New means of utilizing coal. F. MUHLERT. *Apparatebau* 34, 266-70; *Chem. Zentr.* 1922, IV, 854.—A discussion of the gasification of coal with recovery of by-products, including the Thyssen revolving furnace with recovery of crude tar, the Besemfeld method, the double gasification process of Strache, the triple gasification process of Dolensky, the Dellweck-Fleischer-water-gas process and the production of water gas by elec. heating according to Helfenstein.

C. C. DAVIS

Low-temperature carbonization. JOHNSTONE TAYLOR. *Am. Gas J.* 118, 561-4 (1923).—Details of construction and operation of the retorts for *Coalite*. J. L. WILEY

Study of some physical laws governing the carbonization of coal. A. W. WARNER. *Am. Gas Assoc. Monthly* 5, 431-41(1923).—Five basic laws governing carbonization have been deduced from exptl. researches on specially devised app. with the view of establishing a fundamental process whereby the low-volatile close-grained coke of the

coke oven, the high yield of low-temp. and complete-gasification oils, and a medium high yield of high-B. t. u. gas may be retained. (1) If the removal of volatile matter from coking coal were the only consideration, the high heats commonly used in carbonization are unnecessary. Coal can be completely softened and its coking properties eliminated at a temp. under 700° F. Under certain conditions, a heat under 1050° F. can drive off practically all of the volatile matter from coal. (2) The condensable hydrocarbons of coal are more valuable as raw products the nearer to their primary state they exist because no way has been found of converting any but a meager portion of them into gas. (3) The less the cracking and the more the distn. of condensable hydrocarbons occurs, the less will be the intensity of the heat required to drive off the volatile matter from the coal. The exptl. results from the app. indicate that it is possible to produce simultaneously from coking coal a full yield of gas and of low-temp. tars and a low-volatile close-grained coke. (4) The less the heat through which the gases from the non-condensable hydrocarbons must pass in leaving the retort, the richer will be the gases and the greater will be the B. t. u. ft. per unit of coal. (5) The closer the ideals of 4 are met, the greater will be the possible cu. ft. of mixed gas of a detd. B. t. u. per unit of coal.

J. L. WILBY

The liquefaction of coal. D. BROWNLEE. *Petroleum Times* 10, 69-71(1923).—A general review of the work done on hydrogenation of coal is given with particular reference to that of Bergius, whose process is described.

D. F. BROWN

Determination of moisture in coal by the xylene method. E. MERTENS. *Bull. fed. ind. chim. Belg.* 1922, 109-18; cf. *C. A.* 17, 197.—The xylene method (cf. Schlapfer, *C. A.* 8, 1656) gives higher results for moisture than drying in the oven or in a current of N. It is rapid, simple, and free from errors arising from the oxidation and hygroscopic nature of the material dried. Further, it is applicable to the majority of solid and liquid fuels.

J. S. C. I.

The action of nitric acid on coal. A. V. HENDRICKSON. *Fuel* 2, 103-5(1923).—A study of the action of concd. HNO<sub>3</sub> on several coals, particularly their rise in temp. and their gain in wt. (cf. *J. Chem. Soc.* 8, 9(1892); *Proc. Glasgow Phil. Soc.* 29, 72(1898); *Compt. rend.* 147, 986(1908); 148, 284, 348(1909)). In general the main reaction is a combined oxidizing and nitrating action, without much loss of C as oxides. No loss in wt. was observed. Both the rise in temp. and gain in wt. are functions of the volatile content, probably because of the amt. of action is dependent on the age of the fuel, which in general is related to the volatile content (cf. Percy, *Fuel*, 1875, 300; Donath, *C. A.* 6, 2836.) The coals evolved heat at differing rates. Tables and graphs show the data obtained, but few generalizations are possible.

C. C. DAVIS

The melting point of coal ash. F. S. SINNATT, A. B. OWLES AND N. SIMPKIN. *Collier & Guardian* 125, 1131(1923).—A new method for detg. the m. p. of coal ash, used successfully for 4 yrs., is described. A small compact furnace of MgO brick is bored through the center to take a SiO<sub>2</sub> tube. A vertical hole at right angles serves for heating the SiO<sub>2</sub> tube with an oxy-coal gas burner beneath the brick. Detns. are made with 0.2 g. of ash, prepd. in thread shape. Ash from coal from different horizons in the same seam varied considerably in m. p., showing the need of careful sampling. Certain bands in a seam had a very high m. p. (over 1440°) compared with the bulk of the seam. No relation was found between m. p. and chem. compn.

C. C. DAVIS

Various systems of burning pulverized coal. C. F. HERRINGTON. *Blast Furnace & Steel Plant* 11, 345-7(1923).—A comparison of the bin, air-distribution and unit systems, with estd. costs for different types of installations. Any system should be operated with (1) dry coal, (2) coal pulverized to a definite fineness depending on conditions, (3) adequate combustion area with walls kept incandescent, (4) a supply of air in proper amt. to furnish the O to burn the C to CO<sub>2</sub> and (5) an unvarying supply of fuel delivered at a low velocity with its correct proportion of air. Only the bin and air-distribution systems fulfil requirement (5). The relative costs of the coal plant and the systems (8 furnaces, each 300 lbs. pulverized coal per 10 hrs.) are calcd. to be: plant \$30,000, (1) \$21,700, (2) \$15,700, (3) \$47,600.

C. C. DAVIS

Some experiences with mechanical grates for burning low-grade brown coal. SCHÖNE. *Arch. Warmewirtschaft* 4, 27-8(1923).—Ordinary brown coal is best burned on hand-fired step grates. With impurities not more than 15% mech. grates are good, but require close attention. Above 15%, especially if sand is present, the coal is hard to burn. Forced draft is not in general advisable.

ERNEST W. THIELE

Peat in 1922. K. W. COTTRELL. U. S. Geol. Survey, *Mineral Resources of U. S.*, 1922, Pt. II, 5-6 (preprint No. 2, publ. May 31, 1923).

E. J. C.

Utilization of waste gas. P. MORGENSTERN. *Die Wärme* 45, 343-7; *Chem. Zentr.* 1922, IV, 684.—Various methods are given with examples for making use of

waste heat, such as the direct heating of a material, heating for air drying, producing steam, superheating steam, etc.

C. C. DAVIS

**Producer-gas and gas-producer practice.** II. R. V. WHEELER. *Fuel* 2, 106-10 (1923); cf. C. A. 17, 2043.—From a discussion of producer-gas expts. made previously by Bone and Wheeler (cf. *J. Iron Steel Inst.* 1907, 162; 1908, 204; C. A. 3, 1073) it is concluded that at plants where the quality of gas for heating and power is the chief consideration, a steam-satn. temp. of the blast of not much more than 50-5° should be employed and the CO<sub>2</sub> should average not much over 3.5% with a blast superheated to approx. 250°.

C. C. DAVIS

**Low-temperature carbonization by the medium of water gas: the Marshall-Easton process.** F. D. MARSHALL. *Gas J.* 162, 667-72 (1923).—The plant described is a continuous, automatic, complete-gasification twin-screw retort plant in which the operations of carbonization and water-gas making are carried out independently rather than superimposing the retort on a water-gas generator, to which type M. is entirely opposed. The heating, however, is the same—the hot water gas passing up through the coal charge in the retort, while the blow gases are burned in the checkerwork surrounding the retort. By this dual arrangement, the supply of coke to the generator is capable of adjustment to the quality of gas desired from 260 to 550 B. t. u. per cu. ft. of mixed gases. The whole of the tar oils is conserved. Likewise carbonization by this process can be effected more quickly, as a 1.25 in. thick Si cast-iron retort is used with a coal layer of 4.5 in. instead of a 3-in. fireclay retort with a 2 to 3 ft. thickness of coal. A special feature of the plant is twin propellers extending the length of the retort, serving thus for both automatic and continuous feeding and discharging, and travelling in the same rotary direction, but arranged so that the blades of one propeller scrape those of the other, thus preventing the coal from sticking in the retort. The material is not mixed but just propelled downwards. The coal disposes itself automatically in the spaces between the helices in 2 segmental rings, 6 in. high and 4.5 in. thick in the form of an hr.-glass; the circumference of the 2 rings together is 7.5 ft. in a retort having a 10-ton-per-day capacity. There are from 20 to 40 helices of 18 to 24 in. diam. Many data are given as to low-temp. carbonization by recoverable heat during the process of water-gas production, also regarding the heat available from water gas manuf., the production of mixed gas, the by-products, cost of operation, etc.

J. L. WILEY

**Comparisons of some methods of running water-gas plant.** J. C. KING AND J. FRASER-SHAW. *Fuel Research Board Tech. Paper* No. 6; *Gas J.* 162, 662 (1923); *Gas World* 78, 518.—A comparison is made between tests carried out on a Humphreys and Glasgow blue water-gas plant, and those made by the Inst. of Gas Engineers in 1921 (cf. C. A. 15, 2709) with the same app. The former were made partly by the Dellwik-Fleischer system with thin fuel bed and large grate area, the latter with a deep fuel bed. As in the latter case, trouble was experienced with the deposition of a fine dust in the service pipes, etc. It was found on analysis to consist of about 75% of Si. The difficulty was obviated by introducing a moistening box between the holder and the distributing main by which about 85% of the dust was removed. The thermal efficiency obtained in the tests for the Dellwik-Fleischer system was 56% and for the deep fuel bed 54.9%. The temp. prevailing in the system was carefully studied and reported by means of graphs, whereby variations could be readily traced.

J. L. W.

**Manufactured gas in the home.** S. S. WYER. U. S. Nat. Museum, *Bull.* 102, Pt. 8, 24 pp. (1923).—Economic aspects of manufactured gas and general instructions for its use in the home.

J. L. WILEY

**Steam requirements of a gas plant.** A. D. WHITTAKER. *Gas Age-Record* 51, 817-20 (1923).—Details of steam consumption at Atlanta show 96 lbs. of steam consumed per 1000 cu. ft. per 24 hr.: 57 for water gas, 44.5 for coal gas and 44.5 for mixed gas. The monthly cost of steam per 1000 lbs. is 0.268 cents; a waste-heat boiler is used in connection with the coal-gas benches.

J. L. WILEY

**Evaporation experiments at the Victor mine with a double fire-tube boiler equipped for combined gas and coal firing.** M. SCHIMPF. *Glückauf* 59, 514-6 (1923).—A discussion of the conditions of operation under which a combination of gas and coal firing is economical, and the development of equipment for this process, with particular reference to the process developed by Buschmann at the Victor mine.

C. C. DAVIS

**New diagrams for the valuation of fuel gas and flue gas analyses.** WILHELM SCHULTES. *Die Wärme* 45, 213-8; *Chem. Zentr.* 1922, IV, 684.—The diagrams of Ostwald, Seufert and Krämer are complicated in form, are too exact for technical work and do not permit direct graphical readings of the heat losses. By simplifying the formula upon which they are based, a simpler representation of the combustion triangle is derived, with diagrams which allow a direct valuation of analysis.

C. C. DAVIS

**Duplex-mono (fuel-gas tester for carbon dioxide content and loss in gas).** K. MÜNZER. *Die Wärme* 45, 377-9; *Chem. Zentr.* 1922, IV, 818.—With the fuel-gas tester of the Maihak A.G. (Hamburg) two measurements are made successively with equal vols. of flue gas. In the first measurement the  $\text{CO}_2$  content is detd. in the ordinary manner by absorbing the  $\text{CO}_2$  in KOH. For the second measurement the gas is automatically reversed and the measured vol. is led into a small elec. furnace where combustible gases still present ( $\text{CO}$ ,  $\text{CH}_4$ ,  $\text{H}$ ) are burned, after which the  $\text{CO}_2$  is again absorbed in KOH. The difference between the first and second detns. of the  $\text{CO}_2$  is a measure of the completeness of the combustion. C. C. DAVIS

**The hyperbolas of flue-gas constituents.** GEORG SZENDE. *Feuerungstechnik* 11, 73-6 (1923).—S. describes in detail the construction of diagrams for detg. any 2 constituents of flue gas from the other 2, the fuel compn. being given. ERNEST W. THIELE

**Graphic method for computing heat balance.** F. A. SHORKEY. *Blast Furnace & Steel Plant* 11, 348-54 (1923).—A series of graphs is given to replace the use of formulas for boiler-room computations. The charts are based on no  $\text{CO}$  present and a max. of 19%  $\text{CO}_2$ , and include (1) detn. of  $\text{H}$ , (2) detn. of volatile C, (3) losses due to  $\text{H}_2\text{O}$ , (4) losses due to burning of  $\text{H}$ , (5) losses due to combustible in ash and S correction, (6) losses due to heat in dry flue gases and (7) losses due to  $\text{CO}$  in dry flue gases. C. C. DAVIS

**Methane in steel cylinders as a commercial product and as a starting gas for motors.** J. BRONN. *Auto-Technik* 11, No. 17, 6-8; *Chem. Zentr.* 1922, IV, 855; cf. C. A. 17, 332.— $\text{CH}_4$  in steel cylinders can be regarded as the ideal gas for automobiles. Its special advantages are: (1) its dependability, since it is still gaseous when extremely cold, (2) its direct use in starting motors from its steel cylinders under 150 atm. pressure without danger of ignition, (3) its lower cost of manuf. (6-7 times cheaper than  $\text{C}_2\text{H}_6$ ) and (4) its plentiful supply. C. C. DAVIS

**Corrosion in gas mains and meters.** H. E. WILLIAMS. *Gas J.* 162, 725-6 (1923).—W. agrees with Richardson (C. A. 17, 2493) that the corrosive action of gas is caused chiefly by  $\text{CO}_2$  and moisture with O as an accelerator and not by HCN. The  $\text{FeCO}_3$  first formed is oxidized to  $\text{Fe}_2(\text{OH})_2$  and  $\text{Fe}(\text{OH})_3$  with liberation of  $\text{CO}_2$  for further destructive action. J. L. WILEY

**Corrosion in gas mains and meters.** H. G. COLMAN. *Gas J.* 162, 794 (1923).—HCN is not innocuous in relation to the corrosion of gas mains (cf. Williams, preceding abstr.). On the other hand it initiates the corrosion which is then carried on by the normal rusting action of moist  $\text{CO}_2$  and O. HCN combines with moisture and  $\text{NH}_3$ , forming a soln. contg.  $\text{NH}_4\text{CN}$  which is strongly corrosive, dissolving the protecting oxide layer on the surface of the pipe and exposing it to the action of the  $\text{CO}_2$  and O. J. L. WILEY

**Coke breeze as fuel for steam boilers in Great Britain.** C. H. S. TUPHOLME. *Gas Age-Record* 52, 3-6 (1923).—A discussion of fuel economy in gas-plant boiler houses. J. L. WILEY

**Anthracene content of benzene wash oil.** R. GEIPERT. *Gas u. Wasserfach* 66, 101-2 (1923).—Wash oil gradually loses its lighter constituents and becomes enriched with the higher-boiling fractions including anthracene, which seps. out when its limit of soly. is reached into a hard, stony scale. The benzene wash oil should be as free as possible from anthracene. Its quant. estn. by oxidation with  $\text{H}_2\text{CrO}_4$  to anthraquinone is too lengthy and costly for routine work, while the examn. of the residue above  $300^\circ$  for detection of the anthracene crystals is impractical because of the viscous nature of the fraction. Two tests are proposed: one depending on considering the circulating wash oil as spent when less than 55% distils below  $300^\circ$ ; the other on collecting separately the fractions distg. at  $280-90^\circ$  and at  $290-300^\circ$  and cooling them at  $0^\circ$  for some hrs. Only a small amt. of anthracene is present if crystals appear only in the higher fraction, while with large amts. this fraction not only solidifies but crystals also appear in the lower fraction. If no anthracene is found in the higher fraction, it is quite certain that the oil is practically free from it. Any phenanthrene present is calcd. as anthracene. Naphthalene and anthracene cannot be sepd. at all completely from fresh wash oil by cooling the entire quantity of oil. For removing the former, the fraction boiling up to  $280^\circ$ , and to remove the latter, the fraction boiling above  $380^\circ$ , should be cooled separately. Of the 2 compds. the naphthalene is least harmful, since it passes over with the light fractions and only a little remains in the circulating oil. It would be well to det. what proportion of the fresh oil should distil above and below  $250^\circ$  in order to give the best operating results. The amt. of wash oil recovered from the light fractions and the spent oil is nearly equal to that of the fresh oil: only about 10% needs to be replaced—that part which undergoes resinification or polymerization. J. L. W.

**Recovery of ammonia.** F. PLENZ. *Gas u. Wasserfach* 66, 97-9(1923); *Am. Gas J.* 119, 29-32.—Current gas-works practice is reviewed. The yield of  $\text{NH}_3$  is decreased by high oven temps. and especially by the drawing in of air, while a high moisture content of the coal is favorable. The amts. of free and fixed  $\text{NH}_3$  obtained in the various parts of the app. depend on the process used; whether inclined, vertical or horizontal retorts. Generally, the strongest liquors and the greater part of the  $\text{NH}_3$  are obtained from the air coolers; if these are well cooled 80% of the  $\text{NH}_3$  can be recovered. The further recovery takes place in the washers, which should be either arranged on the countercurrent principle or else be of the rotary type; efficiencies of 95-98% should not be difficult to attain. The weak ammoniacal liquors should be used as the washing medium in the first scrubber and then sent to the still after becoming concd., thus avoiding losses in  $\text{NH}_3$ . The last scrubber should be supplied with fresh water. Likewise the temp. in the scrubbers should be kept as low as possible. The steam consumption per ton of gas liquor is practically independent of the concn. of the liquor, but per ton of finished product it is greater the weaker the liquor. Washing is considered satisfactory even if the washed gas still contains 1-3 g. per 100 cu. m. of  $\text{NH}_3$ .

J. L. WILEY

**The distillation of ammoniacal liquors.** ANON. *Chem. Trade J.* 73, 36-7(1923).—An abstract from the Alkali Inspector's Rept. for 1922. A discussion of the year's progress in the disposal of effluent spent liquors from ammonia distrn. The discussion includes the biol. treatment of the dephenolated liquor, the relation of vol. of feed liquor to that of the spent liquor, the difficulty of estg. the vol., and the control of lime feed to the still. The vol. of a given effluent is related within certain limits to that of the ammoniacal liquor distd. and can be calcd. with some degree of accuracy if the  $\text{NH}_3$  content of the feed liquor is known. Due allowance must be made, however, for the addn. of  $\text{Ca}(\text{OH})_2$  and the admission of steam at the still. It has been assumed that the ratio of final effluent to the ammoniacal feed liquor is 150:100 but 3 expts. show ratios varying from 113:100 to 134:100. Checks on these figures have not been run on a large scale unit. Lime feed should afford an excess of 10-20% over the amt. required to liberate all of the  $\text{NH}_3$  though a much higher excess is often encountered.

W. H. BOYNTON

**The dry cooling of coke.** G. CANTIENY. *Glückauf* 59, 333-9, 357-62(1923).—A discussion of the technic and of the economic possibilities of the dry cooling of coke by inert gases. The patented processes of de Wendel and Schwenke, of Emmscher-Lippe and Heyn, and of Sulzer are described and illustrated. Contrasted with quenching, whereby the heat content is completely lost, the available heat can by dry cooling by inert gases be utilized for producing superheated steam and the increasing requirements for steam in mining and the coke industry be supplied without further expenditure of fuel. It is calcd. that a steam generation of 300-400 kg. per 1000 kg. of coke is possible, depending on the coking temp., and that the cost of equipment and installation is paid for in excess available power in 2.5-3 yrs.

C. C. DAVIS

**The recovery of sulfur from coke distillation gases and the gasification of fuels.** A. HARZER. *Apparatebau* 34, 216-20; *Chem. Zentr.* 1922, IV, 772.—A description of the  $\text{Fe}(\text{OH})_3$  process and the processes of Burkheiser, Feld and Bayer for the recovery of S from coke gases.

C. C. DAVIS

**Forms of sulfur in coke and their relations to blast-furnace reactions.** A. R. POWELL. *Trans. Am. Inst. Mining Met. Eng.* 1923, No. 1219-S, 13 pp., No. 1248-S, 22-8; cf. C. A. 17, 869.—The principles worked out in the earlier paper are employed in an attempt to change the form of S in coke to prevent the contamination of Fe in the upper part of the furnace and possibly, at the tuyère level. At present the coke is steamed, so that at certain temps. the FeS constituent may be decomposed. J. R. CAMPBELL discusses the results of using lined coke in furnace operation in work done 12 years ago.

H. L. OLIN

**Coke quality and blast-furnace operations.** F. W. SPERR, JR. AND D. L. JACOBSON. *Blast Furnace and Steel Plant* 11, 314-18(1923).—The work of H. P. Howland in *Trans. Am. Inst. Min., Met. Eng.* 56, p. 339, was continued by H. Koppers with the steel and furnace plants of Germany. The results of both with conclusions are brought together here, the results showing that the reason for the diff. in coke consumption in diff. furnaces must be in the combustibility of the coke. Other things being equal, the better results are obtained with fast burning coke. Several charts show the wt. of C per 100 lbs. pig iron, quality of furnace gas and distribution of the gas in the furnaces. The results of various furnaces are tabulated. All data observed or obtainable are compiled.

W. A. MUELLER

**Attempts to produce a hard semi-coke.** F. HAUSSER AND R. BESTEHORN. *Ber.*

*Ges. Kohlentechn.* (Dortmund-Eving) No. 2, 112-7(1921); *Chem. Zentr.* 1922, 388.—Lab. expts. show that through compression of the coke during distn. a firm semi-coke can be obtained, whose apparent density is 0.91-1.01, according to the pressure applied, compared with 0.45 for uncompressed and 0.68 for rolled coke. Inherent difficulties are involved in the application of this process on a com. scale. C. C. DAVIS

Rosedale by-product coke ovens and what they accomplish. G. A. RICHARDSON. *Coal Age* 24, 93-8(1923); cf. C. A. 17, 1319.—This plant, which includes 120 Cambria and 88 Semet-Solvay ovens, is unique mainly in being situated on the side of a steep hill and in a deep narrow valley. Exceptional construction difficulties were encountered such as the necessity for sinking caissons 36 ft. for oven foundations. The selection of the site was justified by proximity to ample coal supplies and the possibility of substituting gravity flow for pumping. H. L. OLIN

The combustion of complex gaseous mixtures. II. Mixtures of carbon monoxide and hydrogen with air. WM. PAYMAN AND R. V. WHEELER. *J. Chem. Soc.* 123, 1251-9(1923); cf. C. A. 16, 1851.—By means of the "law of speeds" it is possible to calc. the speed of uniform movement of flame in any mixt. of air with a complex inflammable mixt. provided the speeds of the flames in mixtures with air of each of the inflammable gases taken are known. With CO and air, however, the speed is dependent upon the amt. of H<sub>2</sub>O vapor present, the max. effect being obtained with 6% H<sub>2</sub>O. About 3% H<sub>2</sub> in a CO-air mixt. with H<sub>2</sub>O absent (mixt. dried with CaCl<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> but not P<sub>2</sub>O<sub>5</sub>) give the "effective" speed obtained with H<sub>2</sub>O. Tables showing the accuracy of the law of speeds as applied in calcs. are given. H. L. OLIN

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DEVILLE, ÉMILE SAINTE-CLAIRE: Manuel de chimie gazière; méthodes et procédés des essais et analyses en usage à l'usine expérimentale de la Villette de la Société du Gaz de Paris. Paris: Dunod. 208 pp. F. 21.

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MÜNSTER, WILHELM: Die flüssigen Brennstoffe. Kempten: Verlag J. Kosel & F. Pustet. 145 pp.

RAMBUSH, N. E.: Modern Gas Producers. London: Benn Brothers, Ltd. 545 pp. 55s.

WEISSGERBER: Chemische Technologie des Steinkohlenteers mit Berücksichtigung der Koksbereitung. Leipzig: Otto Spamer. 141 pp. Price: paper 4s. 2d., bound 6s.

WINTNER, HEINRICH: Die festen Brennstoffe. Kempten: Verlag J. Kosel & F. Pustet. 92 pp.

Powdered fuel. E. P. C. GIROUARD and F. W. S. JONES. *Brit.* 190,507, June 28, 1921. Coal is distd. between 350° and 700° until the residue, which still contains from 6 to 18% of volatiles, is fragile. The residue is then cooled and finely powd. so that it may be used as a fuel when projected into a combustion chamber with the proper proportion of air. If the volatile content of the coal is low a mixt. may be made with bituminous coal or other bituminous matter. The pulverization is preferably carried out at the place where the fuel is burned, and may take place in two stages first crushing and second grinding to powder.

Motor fuel mixture. F. W. ROHRS. U. S. 1,460,767, July 3. Acetone 1-3, a petroleum distillate such as a mixt. of kerosene and gasoline 25-35 and C<sub>4</sub>H<sub>8</sub> 50-80 parts is used; the amt. of C<sub>4</sub>H<sub>8</sub> is varied as temp. conditions vary. Cf. C. A. 16, 822, 3384.

Plastic fuel mixture. W. E. TRENT. U. S. 1,461,167, July 10. A plastic fuel mixt. adapted for use in gas manuf. or in furnaces is formed of powd. coal 60-80, oil 15-30 and H<sub>2</sub>O 5-10%.

Liquid fuels. RICARD, ALLENET ET CIE, DISTILLERIES DES DEUX-SÈVRES. *Brit.* 191,000, Oct. 13, 1922. A homogeneous mixt. of alc. and gasoline, with or without other fuel substances such as benzene, is obtained by the addn. of normal butyl alc. Thus a mixt. of 4.75 vol. of BuOH with 100 vol. of gasoline (sp. gr. 0.729) dissolves in all proportions in a mixt. of equal parts of alc. and benzene, and 100 vol. of gasoline mixed with 6.5 vol. of BuOH is sol. in all proportions in alc. A mixt. of 100 vol. of gasoline, 12 vol. of alc., and 10 vol. of benzene requires 2.4 vol. of BuOH to render it homogeneous at 0°, 3.5 vol. at 13°, and 4.75 vol. at -0.5°.

**Fuel briquet.** TOICHIRO SHIRAI. Japan. 41,601, Jan. 30, 1922. The briquet is a compressed mixt. of 35 parts of powdered coal, 5 parts of  $H_2SO_4$ -residue obtained in washing of Mond gas, and 7 parts of peat.

**Heating carbonaceous material.** E. STANSFIELD. U. S. 1,459,932, June 26. In carbonizing coal, peat or lignite or in carrying out similar operations, the material is passed by gravity downwardly through an inclined retort, in which it is heated to a progressively increasing temp. A discharge device regulates the outflow of material from the retort and serves also to control the time of heating. Exit pipes are provided at intervals to lead volatilized products from the retort. Cf. *C. A.* 16, 3196.

**Retorts for "devolatilizing" coal.** C. M. GARLAND. U. S. 1,460,414, July 3.

**Purifying gases and liquids.** KOPPERS Co. Brit. 190,115, Oct. 3, 1922.  $H_2S$  and other gaseous impurities such as  $CO_2$  and  $HCN$  are removed from gases and liquids by a process of absorption in alk. solns. The absorption soln. is regenerated and the  $H_2S$ , etc., removed by heating the soln. and regulating the pressure. A suitable construction is specified.

**Purifying gases.** KOPPERS Co. Brit. 190,116, Oct. 3, 1922.  $H_2S$ ,  $HCN$  and other impurities are removed from gases by first passing the gas into contact with an alk. absorbent such as  $Na_2CO_3$  to absorb the bulk of the impurities and subsequently treating the gas with more absorbent to remove the residue of the impurities, the absorbent from each stage being separately revived. A suitable construction is specified.

**Purifying gases.** KOPPERS Co. Brit. 190,117, Oct. 3, 1922. Gases contg. impurities, particularly  $H_2S$  and  $HCN$ , are treated with impurity-absorbing liquid, such as a soln. of  $Na_2CO_3$ , which is then directly revived by aeration, stagnation being avoided. A suitable app. is specified.

**Purifying gases.** KOPPERS Co. Brit. 190,119, Oct. 3, 1922. Gases such as coke oven gas are purified from  $H_2S$ ,  $HCN$  and other impurities by treatment with the soln. of an alkali such as  $Na_2CO_3$  which is then revived by passage over  $Fe_2O_3$ . A suitable construction is specified.

**Purifying gases.** KOPPERS Co. Brit. 190,131, Nov. 27, 1922.  $H_2S$  and other obnoxious gases such as  $HCN$ ,  $CO_2$ , etc., are removed from coke-oven gases, etc. by absorption in alkali, the latter being regenerated by interaction of the fouled liquor with hydrated  $Fe_2O_3$ , basic  $Fe$  carbonate or other appropriate  $Fe$  compds. with the formation of  $FeS$ . The latter is sepd. from the alkali, which is returned to the process and is aerated to re-form the oxide and liberate the  $S$ . A suitable construction is specified.

**Recovery of hydrocarbons and sulfur from coal gas.** BADISCHE ANILIN & SODA FABRIK. Brit. 190,203, Aug. 17, 1921. Coal or coke-oven gas, previously freed from tar, cyanogen compds., and part of the  $NH_3$  content, is passed at ordinary or slightly raised temp. through a no. of towers contg. active charcoal, such as is obtained by charring wood with  $ZnCl_2$ . In the first towers, all the benzene hydrocarbons are absorbed; in the next towers, the  $H_2S$  is removed in the state of free  $S$ , after a sufficient amt. of O-contg. gas with or without  $NH_3$  has been added; finally, if desired, the  $C_2H_4$  hydrocarbons are absorbed in the last towers. By employing an arrangement of interchangeable towers, the process may be conducted in a continuous manner. Org. S compds., if present, are retained in the first towers along with the benzene hydrocarbons; any  $HCN$  present becomes converted into  $NH_4SCN$  and is also deposited in the first towers. The  $C_2H_4$  may be freed from  $NH_3$ , before or after absorption, by washing with aq.  $H_2SO_4$  or other acid. Instead of absorbing  $C_2H_4$  as such in the last towers, it may be converted into  $C_2H_4$  compds. by interaction with halog. etc., in the presence of the active charcoal, and these compds. are then retained. The absorbed substances are removed at intervals by extrn. with a solvent or by expulsion with steam. Cf. 153,297, 170,152, and 177,362.

**Apparatus for generating welding or other gases.** F. BELLVILLE, E. A. BELLEVILLE and R. S. HENDERSON. U. S. 1,461,377, July 10. Gasoline, ether and camphor may be used for making a welding gas.

**Retort for making gas from straw.** G. H. HARRISON. U. S. 1,461,614, July 10. Cylindrical retorts extend horizontally through a furnace and are connected, with feeding tubes having perforated pistons.

**Supporting device for gas-retort spouts.** R. M. SEARLE. U. S. 1,460,925, July 3.

**Gas scrubber.** H. G. JOHNSTON. U. S. 1,460,490, July 3.

**Apparatus for producing coke and gas.** E. BARRS. U. S. 1,460,638, July 3. Material such as coal for distn. or coking is fed continuously through a tubular retort, a portion of which is surrounded by a heating jacket and another portion of which is surrounded by a jacket communicating with the retort for withdrawal of gas.

**Apparatus for semicoking coal, etc.** KARL PRINZ ZU LÖWENSTEIN. U. S. 1,460,024, June 26. Coal, slate or other material to be heated is fed onto the upper surface of a rotating horizontal disk, heated from below and enclosed within a retort chamber.

**Apparatus for coking pitch or similar liquefiable bituminous material.** F. PURNING. U. S. 1,461,324, July 10.

**Sealing vertical coking chambers.** J. SCHÄFER. U. S. 1,460,828, July 3.

**Reversing mechanism for by-product coke ovens.** L. F. SCHRADER. U. S. 1,460,829, July 3.

## 22—PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

**Petroleum.** W. RAMSAY. *J. Soc. Chem. Ind.* 42, 287-8T(1923).—In support of Sabatier and Senderens' theory of the origin of petroleum (hydrogenation of carbon compds.), a no. of authentic samples of crude petroleum, asphalt and ozocerite were examd. for their Ni content. Ni was found in all; Mexican crude petroleum, *e. g.*, contained 49 to 83 parts per million. The insol. portion of the petroleum (filter paper used to sep. it) contained only a trace of Ni. S compds. and CO are catalyst poisons, but the former may have been acquired subsequent to the hydrogenation or the "poisoned" catalyst may have been regenerated in some way. W. FARAGHER

**Preparation of petroleum from fatty oils.** II. MASAKAZU INOUE. *J. Chem. Soc. Japan* 44, 78-110(1923); cf. C. A. 16, 2025.—A complete review of the artificial prep. of petroleum from fatty oils is given. In continuation, the following expts. were done: (a) Effect of different catalyzers. Of Fe, Cu, Ni and brass used, Fe adheres to C and is not effective. Ni and brass are good only when used fresh. Cu is not as good a catalyzer as Ni and brass but it can be used repeatedly without losing its effectiveness. (b) Effect of Cu catalyzer at different temps. With uniform temp. of the catalytic decompn. chamber, the distillate produced by Cu as catalyzer is greater in both low and high boiling fractions as the temp. of the chamber is increased, probably because of distn. of partially decomposed oil. In order to prevent this, the decompn. should be conducted first in a higher temp. chamber (500°) and the resulting product should then be passed into the second chamber (200-250°) before being subjected to the condensation. (c) Distn. of Ca soaps of different fats. The results obtained from drying oils (linseed, paulownia) semi-drying oils (soy-bean, cottonseed, rape-seed) and non-drying oils (peanut) and animal fat (suet) were the same as those with sardine oil. For minor differences, a later report is promised. (d) Distn. of different metal soaps of sardine oil. Similar results were obtained with Pb and Na soaps as with Ca. (e) Analysis of the distillate from Ca soaps of sardine oil is given for each fraction at 25° intervals, including d., color, acid no. and H number. (f) The nature of the gas. The gas is easily combustible, producing 12,000 cal. per l. and contains 7.4% CO<sub>2</sub>, 7.9% CO, 33.6% unsatd. hydrocarbons, 38.2% satd. hydrocarbons and 12.9% H<sub>2</sub>. (g) The coke contains 1.04% H<sub>2</sub>O, 56.89% ash, 0.09% S, from which CaO and CaCO<sub>3</sub> and catalytic metals can easily be removed. S. T.

**Operating practice in refining cracked petroleum distillates.** GUSTAV EGLOFF AND J. C. MORRELL. *Chem. Md. Eng.* 29, 63-4(1923).—Pressure distillates contg. little S are refined with 66° Bé. H<sub>2</sub>SO<sub>4</sub> (1-7 lbs. per bbl.), added in several portions. (The use of fuming acid has never been found necessary.) Thorough washing follows the acid treatment. Neutralization is effected with a soln. of NaOH, and is followed by washing. Keeping qualities are improved if the distillate is then treated with "doctor" soln., and washed. Steam distn. is the final step. The above scheme is followed for distillates high in S, with the exception that more "doctor" soln. is used. No S is added, as a rule. In exceptional cases a heavy "doctor" treatment is given before the acid treatment. S may be used in this case to assist ptn. Continuous processes are strongly recommended in order to minimize losses. W. F. FARAGHER

**The desulfurizing of Mexican oil distillates according to the Frasch method.** D. W. SISSINGH. *Brennstoff-Chem.* 4, 113-18(1923).—A distn. of Mexican crude oil, d. 0.976, was made according to the method of Engler. When the temp. of the vapor reached 200° superheated steam was introduced into the still. The distillates were sep. into 5 fractions according to their sp. gr.: (1) heavy benzine, below 0.820; (2) kerosene, 0.820-0.850; (3) gas oil, 0.850-0.900; (4) spindle oil, 0.900-0.940; (5) machine oil, above 0.940. The av. S content of crude oil was 5.0%. The individual fractions had the following S contents in %, resp., 1.27, 1.48, 2.32, 2.60, 3.64, residue, 5.7. Seven



distns. were carried out according to the method described with the following desulfurizing agents; (1) 500 g. CuO with 700 g. oil; (2) a mixt. of 1.125 kg. CuO, 0.150 kg. PbO, and 0.225 kg. Fe<sub>2</sub>O<sub>3</sub> with 0.40 kg. oil; (3) 720 g. Fe<sub>2</sub>O<sub>3</sub> with 600 g. oil; (4) *lux masse* (53% Fe<sub>2</sub>O<sub>3</sub>) with oil; (5) a mixt. of 1.23 kg. CuO, 0.17 kg. PbO, and 0.17 kg. Fe<sub>2</sub>O<sub>3</sub> with 0.40 kg. oil; (6) 1.6 kg. CuO, mixed with oil by use of an air blast until the temp. at which superheated steam is introduced, has been reached; the still was not fitted with an agitator; (7) the same method as (6) with a mixt. of 1.42 kg. CuO, 0.18 kg. PbO, and 0.230 kg. Fe<sub>2</sub>O<sub>3</sub> with oil. Method (6) gave the best results. The S contents in % of the various fractions were 0.78, 1.22, 1.00, 1.28, 1.32, resp. Fe<sub>2</sub>O<sub>3</sub> gave the poorest results. The oxide mixt. gave only slightly better results than Fe<sub>2</sub>O<sub>3</sub> alone.

C. T. WHITE

**Direct determination of dew-points of gasoline-air mixtures.** W. A. GRUSH. *Ind. Eng. Chem.* 15, 796-9 (1923).—Mixts. of gasoline-air are formed continuously by introducing the gasoline at a regular rate into a stream of air. The mixt. is then passed over a small metallic mirror (Monel or gold), which forms a part of the wall of a Cu test-tube. The mirror is cooled by evap. a suitable liquid from the test-tube. Dew-points detd. directly are considerably higher than those detd. by the indirect method of Wilson and Barnard (*C. A.* 16, 153).

F. A. FARAGHER

**"Jitney unit" is latest gasoline plant.** ANON. *Refiner & Nat. Gasoline Mfr.* 2, No. 1, 17-18 (1923).—The equipment consists of an absorber, still, pump, condenser, heat exchanger and connections. The absorber is divided into 3 sections horizontally. Oil from the absorber enters the still at the bottom and is forced up through tubes in one section and flows downwardly through similar tubes in the other section of the still. The inlet tubes are surrounded with steam while steam is admitted through the exit tubes. The absorber oil circulates between the absorber, still and heat exchanger. The cost of the total equipment is about \$5000 and all except the condenser is portable.

D. F. BROWN

**The dry distillation of xylans.** EMIL HEUSER AND ARTHUR SCHERRER. *Brennstoff-Chem.* 4, 97-101 (1923).—Xylan dry-distd. at atm. pressure gave aq. distillate, 43.8%, gas, 18.0%, tar, 6.7%, residue, 31.5%. The distn. took place chiefly between 160° and 315°. The total acidity as AcOH in the distillate was 17.06%. The furfural content was 13.77%. Allyl alc. also was identified. Distn. under a vacuum of 1 mm. Hg up to 300° gave 22.0% aq. distillate, 23.1% gas, 20.2% sirup, and 34.7% residue. After several days crystals sepd. from the sirup, which after recrystn. from EtOAc gave a colorless compd., C<sub>8</sub>H<sub>8</sub>O<sub>4</sub>, m. 206.5°. The investigation of this product and other constituents of the sirup is to be continued.

C. T. WHITE

**Hydrogenation of paraffin by the Bergius method.** H. I. WATERMAN AND J. N. J. PERQUIN. *Proc. Acad. Sci. Amsterdam* 26, 226-30 (1923).—The cracking of paraffin in a gas-heated, 2500-cc. autoclave to 435° alone and in the presence of H<sub>2</sub> at pressures varying during a particular expt. from 40 to 110-20 atm. was studied. The properties of the paraffin were: d<sub>4</sub><sup>15</sup> 0.913, Shukoff solidifying point 50.6°, and McKiney bromine no. (addition) 0.5. The oils obtained in the Bergius expts. were yellow to red and transparent. Those obtained when no H was introduced were dark and opaque. A small quantity of carbon was deposited in both cases, but is regarded as negligible. The paraffin was entirely converted to oil and gas in both processes. In both methods the distillate to 220° was 22.8-25.0% after 1 hr. at 435°, 36-42% after 2 hrs., 52-56% after 3 hrs. and 57-60% in 4 hrs. The loss as gas in no case exceeded 7%. The sp. gr. of the products formed in the "berginization" expts. was always less than those of the products of the plain cracking method. Considerable quantities of H are absorbed in "berginization." The bromine addition numbers of the products of "berginization" are somewhat lower (19, 20.8 and 20.8 as compared to 27.6, 26.1, and 23.9) than those of products cracked without H. The cracking process of Bergius is deemed preferable to cracking without hydrogen under pressure.

E. H. LESLIE

**Vapor pressures of solutions of benzene, hexane, and cyclohexane in various types of lubricating oils, with molecular weight data.** R. E. WILSON AND E. P. WYLDE. *Ind. Eng. Chem.* 15, 801-9 (1923).—Oils made from California, asphalt-base, and paraffin-base petroleum, as well as castor oil, were employed. For a given mean mol. wt., the deviations from Raoult's law arranged the oils in the following order of increasing tendency to absorb the volatile hydrocarbons. California, asphalt-base, paraffin-base and castor. This order, however, is just the order of increasing mol. wt. for a given viscosity. It follows, therefore, that the two effects are antagonistic, and as a result the differences in tendency to absorb volatile hydrocarbons in mineral oils suitable for a given purpose are small. The tables and graphs presented make possible an intelligent

approx. detn. of the behavior of various pairs of heavy mineral oils and volatile solvents over a considerable range of temp. W. F. FARACHER

The production of lubricating oil from coal tar. A. R. MATTHIS. *Bull. fed. industr. chim. Belg.* 1922, 365-6; *Chem. Zentr.* 1922, IV, 647-8.—A description of the coal-tar distillate known as "fat tar oil," whose use as a lubricating oil is constantly increasing. This oil has  $d_{40}^{20}$  1.12, viscosity according to Engler 2-2.5 at 50°, flash p. 140°, m. p. -10°. A disadvantage of this oil is that at lower temps. on account of the presence of anthracene, phenanthrene, etc., it becomes viscous and clogs the tubes and valves. By a patented process (German patent 330,970) this disadvantage has been overcome through conversion by means of S of hydrocarbons sol. in the oil to  $H_2S$  and removal by distn. C. C. DAVIS

The hydraulic theory of oil migration and accumulation (RICH) 8.

BACON, RAYMOND FOSS, AND HAMOR, WM. ALLEN: *The American Petroleum Industry*. New York: McGraw-Hill Book Co., Inc. Vol. I. 456 pp. Vol. II. 519 pp. \$12 per set. Not sold separately.

GIARDINA, PIETRO: *Le miniere di asfalto*. Revised ed. Turin: Unione tipografico-educatrice. 42 pp. L. 3.

HOLME, D.: *The Examination of Hydrocarbon Oils and of Saponifiable Fats and Waxes*. Translated from the 5th German edition by E. Mueller. London: Chapman & Hall. 30s. net. Reviewed in *J. Inst. Petroleum Tech.* 9, 208(1923).

SCHNITHTAUER, W.: *Shale Oils and Tars and Their Products*. 2nd ed. revised and enlarged by H. B. Stocks. London: Scott, Greenwood and Son. 283 pp. 12s. 6d. Reviewed in *Chem. Trade J.* 72, 705(1923).

SCHENKER, W.: *Fuel and Lubricating Oils for Diesel Engines*. New York: Van Nostrand. \$3.00.

Purifying petroleum, etc. A. E. DUNSTAN and F. G. P. REMFRY. Brit. 190,553, Sept. 28, 1921. Petroleum and other liquid hydrocarbons are desulfurized or decolorized by successive treatment with fuller's earth or floridin and another colloidal gel such as bauxite or alumina. The adsorbents are preferably used warm after roasting, and the oil is dried before treatment. According to the Provisional Specification the bauxite may be used first.

Cracking hydrocarbon oils. A. A. F. M. SEIGLE. Brit. 190,723, Dec. 20, 1922. Hydrocarbon oils such as petroleum, peat, shale, or lignite oils, heavy tars, resin oils, naphthalene oils, etc., are vaporized by being fed from a tank through a preheater to the lower part of a vertical annular retort heated by a flame projected down the central cavity from a burner. The oil vapors rise through annular passages formed by disks on which are placed chips of Cu, Fe, Al, Ni, etc., to act as catalysts. The vapors, which attain a temp. of 550-650°, pass from the top of the retort to coolers, which are surrounded by jackets contg.  $CaCl_2$  soln. or  $H_2O$  which, by liberation of steam under pressure, maintains definite temps. of about 250-300° and about 180° in resp. coolers. The vapors are finally passed to a water-cooled condenser and either to a compressor or a scrubber, in which they are washed with heavy oil. The residual gas may be used for lighting railway carriages, etc. A suitable construction is specified.

Purifying hydrocarbon oils and tars. A. B. FOSTER. Brit. 190,754, Aug. 23, 1921. Hydrocarbon oils or tars are intimately mixed with a liquid reagent by impacting two or more powerful streams of the oil or tar and introducing the reagent into one or more of the streams before or at the point of impact. After the mixt. has settled, the purified product is drawn off. A suitable construction is specified.

Apparatus for cracking hydrocarbon oils under pressure. J. H. ADAMS. U. S. 1,461,017, July 3. Liquid oil is continuously passed into a converter surrounded by a furnace above its lower end so as to maintain a substantially const. oil level under vapor pressure in the converter. Cf. C. A. 17, 1547.

Recovering aluminum chloride used as a catalyst in treating hydrocarbon oils. E. V. OWEN. U. S. 1,460,110, June 26.  $AlCl_3$  mixed with hydrocarbon material, e. g., the residual mixt. obtained by catalytic treatment of hydrocarbon oils, is impinged while still in fluid condition against a revolving disk or other surface heated to a temp. sufficient to volatilize the  $AlCl_3$  while permitting hydrocarbon to settle out, and the volatilized material is recovered. Cf. C. A. 16, 4057.

Briquetting oil shales. H. CURTIS. Brit. 189,977, Nov. 18, 1921. The briquets are produced from Norfolk and other oil shales.  $KNO_3$  or  $NaNO_3$ , or a mixt. of these

two substances, is introduced into the powd. shale to purify the shale from S and other deleterious substances, and to prevent the formation of "cores."

**Sulfonation products from gilsonite.** C. N. FORREST, H. P. HAYDEN and O. R. DOUTHETT. U. S. 1,459,328, June 19. A semi-drying, viscous oily product which when mixed with linseed oil causes it to dry homogeneously instead of with a surface film is obtained by subjecting an intermediate distillate from gilsonite to a purification with  $\text{H}_2\text{SO}_4$  and then to a sulfonation treatment with concd. or fuming  $\text{H}_2\text{SO}_4$  while agitating, sepg. the acid sludge and allowing it to stratify after addn. of  $\text{H}_2\text{O}$ , segregating the upper layer which thus forms and washing it with alk. soln.

**Determining gasoline in gas.** A. CLARKE. U. S. 1,461,345, July 10. A measured quantity of natural gas or other gas to be tested for its gasoline content is compressed and cooled by the action of  $\text{H}_2\text{O}$  or other cooling liquid under pressure, to liquefy the gasoline, and the liquefied gasoline is then measured.

**Gasoline filter.** W. C. STROWBRIDGE. U. S. 1,460,867, July 3.

**Flocculating clay in well drilling.** F. J. CARMAN. U. S. 1,460,788, July 3. In drilling wells, employing a "mud circulation," a reagent such as NaCl is added to flocculate clay in the circulation.

**Purifying and dehydrating switch oil or similar oils.** C. H. HAPGOOD. U. S. 1,460,718, July 3. The oil is mixed with soap and subjected to successive centrifugal sepn. to remove dirt, soap and  $\text{H}_2\text{O}$ .

**Bituminous clay emulsion.** L. KIRSCHBRAUN. U. S. 1,461,445, July 10. Heated asphalt or other bituminous material is added to colloidal clay and  $\text{H}_2\text{O}$  to form an emulsion and a hydrocarbon oil such as topped Mexican petroleum is then added to constitute an additional internal phase of the emulsion. The product is adapted for impregnating paper or textile fabrics.

### 23—CELLULOSE AND PAPER

CARLETON E. CURRAN

**The industrial retting of the mulberry with aerobic pectic ferments.** GIACOMO ROSSI. *Ann. scuola agr. Portici* (2), 15, 1-6(1920).—Mulberry branches contain 3-4% fiber. The amt. of fiber available for use is less than a twentieth of the cotton imported and hardly sufficient to replace the needs of the Italian explosives factories. Very rapid and complete retting of the entire branches or of the bark alone is brought about in 60 hrs. by use of the Rossi method of microbiological retting, the action of the pectic ferments being controlled and intensified by means of a current of air. The fiber obtained has all the properties required for nitration and does not differ greatly from that of cotton. Tests prove it can be successfully substituted for cotton in the manuf. of nitrocellulose.

ALBERT R. MERZ

Apparatus for electrolytic production of paste or sludge metal or alloys [for coating paper] (U. S. pat. 1,461,276) 4. Bituminous clay emulsion [for impregnating paper] (U. S. pat. 1,461,445) 22.

**ANDRÉS, LOUIS EDGAR:** *Treatment of Paper for Special Purposes. The Preparation of Parchment, Transfer, Fireproof and Antifalsification, Tracing and Copying, Leather, Colored Papers and Paper Articles.* Translated from German. 2nd ed. revised & enlarged. London: Scott, Greenwood & Son. 216 pp. 8s. 6d.

*Die Fabrikation des Zellstoffes aus Holz.* Berlin: O. Elsner, Verlagsges. 367 pp.

**Regenerating sulfurous acid and waste heat from sulfate cellulose boilers.** K. HANGLEITER and A. SCHNEIDER. *Can.* 232,272, June 26, 1923. The pressure in the boilers is lowered by withdrawing much of the gas which is led into a container; then the rest of the gas is withdrawn through another main through which fresh lye is passing to the container. The heat and  $\text{SO}_2$  are absorbed by the fresh lye.

**Colloidal products formed with cellulose waste liquor.** L. BÉREND. U. S. 1,460,012, June 26. Colloidal prepn. are obtained by treating inorg. substances, *e. g.*, compds. of Hg, Cu or Cr, with cellulose waste liquor from either the sulfite or soda process.

**Treating black liquor produced in the manufacture of sulfate pulp.** G. A. RICHTER and D. H. McMURTRIE. *Can.* 232,746, July 17, 1923. The black liquor resulting from the digestion of wood in making sulfate pulp is concd., S is added and the mixt. smelted.

$\text{Na}_2\text{CO}_3$  may be added to the molten effluent to compensate for the loss thereof by the reaction of S with  $\text{Na}_2\text{CO}_3$  initially in the spent liquor.

**Wood pulp.** GEO. H. TOMLINSON. Can. 232,488, July, 3, 1923. Wood is subjected to the action of a weak bisulfite soln. and steam at a temp. below  $130^\circ$ ; the reagent is withdrawn and the pulp is treated with a stronger bisulfite soln. at a temp. below  $150^\circ$ .

**Cellulose acetate; plastic compositions.** BRITISH CELLULOSE & CHEM. MANUFACTURING CO., LTD. Brit. 190,269, Sept. 27, 1921. Plastic compns. consisting of cellulose acetate impregnated with a small proportion of glycerol are prepd. by heating the acetate with excess of glycerol, washing the mass with  $\text{H}_2\text{O}$  until the desired small proportion of glycerol remains, and finally removing the  $\text{H}_2\text{O}$  by evapn. Alternatively, the mass may be washed as free as possible from glycerol, mixed with an aq. glycerol soln. contg. the desired small proportion of glycerol, and freed from  $\text{H}_2\text{O}$  by evapn. A proportion of 3% of glycerol is stated to yield the best results. Plastic compns. so obtained may be molded by heating in a mold for about 15 min. at a temp. of  $400^\circ\text{F}$ ., and then applying pressure to the material in the mold.

**Cellulose ester solutions.** NITROGEN CORPORATION. Brit. 190,694, July 1, 1922. Cellulose esters such as the nitrates are dissolved in liquids in which they are not initially sol., by treating them with liquid anhyd.  $\text{NH}_3$ , transferring the treated ester into the liquids and evapg. the  $\text{NH}_3$ . The ester may be completely dissolved in liquid anhyd.  $\text{NH}_3$ , e. g., as described in 182,488 (C. A. 16, 4346) or may be slightly moistened therewith to form a gelatinous mass, in which case the subsequent admixt. with the liquid may be carried out at atm. pressure. In this way solns. of cellulose nitrates in aliphatic or aromatic alcs. either alone or admixed with esters of these alcs. or with  $\text{CCl}_4$ ,  $\text{CHCl}_3$ ,  $\text{C}_2\text{H}_5\text{Cl}$ ,  $\text{C}_3\text{H}_7\text{Cl}$ , benzene, benzine, or  $\text{C}_6\text{H}_6$ , may be obtained.

**Cellulose acetates; artificial silk, hair, etc.; films.** J. O. ZDANOWICH. Brit. 190,732, June 20, 1921; cf. C. A. 17, 2506. A directly spinnable soln. of cellulose acetate is obtained by conducting the esterification in two stages, in the first without any condensing agent, and then continuing the reaction after the addn. of a quantity of a strong condensing agent not greater than 4% of the wt. of cellulose taken, and preferably of the order of 1% or even less; the first stage is preferably prolonged, is carried out in an open vessel with or without a reflux app. or in a closed vessel under normal or increased pressure, and at temps. of, e. g.,  $40$ – $100^\circ$ ; half the necessary quantity of esterifying agent,  $\text{Ac}_2\text{O}$  or  $\text{Ac}$  chloride, may be added in the first stage, the remainder being introduced before the second stage of the process, and there may also be added a diluent such as  $\text{HOAc}$  or formic acid, or the diluent may be added after the first stage or at the completion of the esterification process. When formic acid is employed, a certain amt. of cellulose formates is present in the soln.; at the completion of the first stage, the cellulose is thoroughly disintegrated, and the resulting paste is cooled to normal temp. or lower, and the necessary quantity of  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$ , chlorosulfuric acid or other strong condensing agent is added, and the reaction continued until a clear, colorless soln. is obtained. For the manuf. of artificial silk, horsehair, etc., the soln., after the extn. of air bubbles and filtering, is squirted into a coagulating bath; or it may be formed into films by spreading a layer on a suitable endless belt partly submerged in a coagulating bath. Cf. 139,232 (C. A. 14, 2084).

**Cellulose ether composition.** W. R. WEBB. U. S. 1,460,690, July 3. A compn. adapted for the manuf. of sheets or films or as a varnish is formed of cellulose ethyl ether and an aromatic side chain alc., e. g., benzyl alc., together with  $\text{MeOH}$ , triphenyl phosphate, camphor or other ingredients. Cf. C. A. 17, 1329.

**Cellulose ether film.** J. M. DONOHUE and E. S. FARROW, JR. U. S. 1,460,097, June 26. A flowable film-forming compn. is prepd. from cellulose ethyl ether together with  $\text{Me}$  acetanilide or other stabilizer of high b. p. capable of producing a film which is flexible when finished after heating at  $65^\circ$ . A volatile solvent such as a mixt. of  $\text{MeOAc}$  and  $\text{MeOH}$  is also used in forming the compn.

**Nitrating apparatus for cotton.** GORO MATSUMOTO and KEITA HIRAYAMA. Japan. 41,524. Jan. 27, 1922. Vessels for nitrating, for removing acid and for washing are so constructed that the cotton is gradually transferred from the nitrating vessel to the washing vessel through tubes attached to the bottom of each vessel. Agitating app. and other suitable mechanical devices are utilized for safe handling.

**Pulp from pine leaves.** TETSURO HIROSAWA and TETSUZO KISHIHARA. Japan. 41,587. Jan. 30, 1922. Pine leaves are immersed in 2–3%  $\text{HNO}_3$  overnight. After drying, they are crushed, sieved, boiled with 0.5–0.8%  $\text{Na}_2\text{CO}_3$  or  $\text{Ca}(\text{OH})_2$  soln. under a pressure of 30–40 lbs., and then with 1%  $\text{Ca}(\text{HSO}_3)_2$  for 0.5 hr. They are bleached and made into pulp.

**Paper.** C. WRYGANG. Brit. 190,185, June 16, 1921. In prepg. straw, particularly wheat and oat straw for paper making, etc., the straw is cut up and soaked for 12-24 hrs. or boiled under low pressure for 3-6 hrs. in a mixt. composed of 8 parts of slaked lime mixed to a thin paste with  $H_2O$ ; 1-4 parts of petroleum or other refined or crude mineral oil, and 4-8 parts of  $Na_2CO_3$  or  $Na_2SO_4$  previously dissolved in  $H_2O$ . Where soaking is used, the straw is piled in heaps, the excess liquor being drained off and used for a fresh lot of straw. After treatment, the material is rinsed and converted into paper in the usual way. The rinsings are used for treating straw to produce coarse paper or boards.

## 24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

**Report of the Chief Inspector, Bureau for the Safe Transportation of Explosives** A. R. A. for 1922. B. W. DUNN. Pamphlet, 77 pp. (Mar. 1923).—The *inherent risk of the 7 most dangerous articles* is found to be  $HNO_3$  2000, gasoline 1880, alc. 1281, matches 1154, high explosives 1060, charcoal 946 and black powder 937. The hazard of gasoline and other petroleum products is greatly increased by the imperfections of the tank cars used, especially in the tapping of the bottoms of these tanks for gravity discharge and dangerous location of loading and unloading stations. Ca and Al soaps, used in water-proofing cement, gave rise to "spontaneous combustion" in consequence of the rapid oxidation of the finely divided material.  $SbCl_5$  was found to produce heat and irrespirable fumes in large quantities when brought in contact with org. matter; it should be packed in inert material. The spontaneous combustion of *box-loc board*, consisting of  $1/8$  in. cotton felt coated on both sides with a mixt. of resins and celluloid, the coating forming about 70% of the total, was found due to the rapid oxidation of the finely divided resinous substance promoted by the cotton, which seems to have a property wool does not possess that promotes this oxidation of resins or oils. For the purposes of transportation *metallic Mg* in a form other than powder or ribbon is not regarded as a hazardous article, but for storage purposes in large amts. it is more of a fire hazard than the more common metals. The explosion of an Fe drum in which  $H_2SO_4$  had been shipped is described and discussed. The coincidence of Pb scrap from storage batteries in a car in which NaCl had previously been shipped, and that rain was falling as the scrap was being hauled to be loaded in the car led to a dangerous generation of Cl, through the dil.  $H_2SO_4$  from the battery plates falling on the NaCl on the floor of the car, thus generating HCl which on contact with the  $PbO_2$  of the grids yielded Cl. Bleaching powder and paraformaldehyde shipped as a disinfectant when mixed together with a little  $H_2O$  produced a violent reaction, considerable heat and a large amt. of inflammable gas. The appendixes describing, with illustrations, accidents from improper packing of  $HNO_3$ , unsafe storage of explosives, and how to handle leaking Cl, are among the many items in this rept. of special interest to chemists.

CHARLES E. MUNROE

**Determination of velocity of explosion waves of small amplitude in sea water. Variation of velocity with temperature.** A. B. WOOD, H. E. BROWNE AND C. COCHRANE. *Proc. Roy. Soc. (London)* 163A, 284-303 (1923).—Four hydrophones were carefully located on the sea bed of St. Margaret's Bay, Dover, at intervals of about 4 miles apart; the distance between the 2 extreme ones was 70,245 ft. Charges of explosive varying from 9 ozs. to 300 lbs. were fired in line with the hydrophones and the time intervals of passage of the explosion wave between the various pairs of hydrophones was obtained by means of a six-stringed Eindhoven galvanometer photographic arrangement. The results were  $V = 4836 (\pm 2)$  ft./sec. at  $6^\circ (\pm 0.1^\circ)$  and salinity 35.1%. Between  $6^\circ$  and  $17^\circ$  there is a change of 10.9 ft./sec. per degree C. and of approx. 3-4 ft./sec. per 1% increase in salinity. No change in velocity was detected with any change in the wt. of charge or depth of immersion.

CHARLES E. MUNROE

**The formation of the explosion wave.** P. LAFFITTE. *Compt. rend.* 176, 1392-5 (1923).—A mixt. of  $CS_2 + 3O_2$  under atm. pressure was ignited at one end in glass tubes of diams. from 6.5 up to 54 mm. and, by the photographic method of Mallard and Le Chatelier the length of zone of combustion preceding the zone of explosion was measured; it was found that beginning at about 25 mm. diam. the length of the zone of combustion was proportional to the diam. of the tube. When the proportion of  $CS_2$  differed by more than 1% of the theoretical mixt. the establishment of the explosion wave was delayed. When there was an interruption of continuity in the tube, it was promoted.

CHARLES E. MUNROE

**Fire-damp and coal-dust explosions.** F. O. H. BINDER. *Chem.-Zig.* 47, 435-8

(1923).—A general review of explosions of mixts. of fire damp, or coal dust, or both, with air, giving physical consts. and limit mixts., with calcs. of explosion temps. for fire damp mixts. with air. The temps. are for 2% firedamp 567°; 2.5% 586°; 5.5% 1089°; 9.5% 1605° and 13.5% 1550°. (Cf. C. A. 17, 884.)

CHARLES E. MUNROE

**Static electricity in conducting tubes as the cause of benzine explosions.** BRUNO MÖLLER. *Chem.-Ztg.* 47, 97-8 (1923).—When benzine flows through a metal tube the benzine acquires a negative charge and the tube a positive one. A potential of 300 v. has been observed. This can be avoided by grounding the tanks. H issuing from a tube also acquires a charge. Instances in which this behavior of benzine has been observed are cited (cf. C. A. 16, 498, 647; 17, 1331, 1332).

CHARLES E. MUNROE

**Technical conversion of nitrous gases into nitric acid and the explosion accident at Bodio.** E. BGRZ. *Z. angew. Chem.* 36, 87-91 (1923).—While in combustion of air a concn. of 1-2% of N oxides is attained  $\text{NH}_3$  combustion yields 8-9%. Under (a) sufficient reaction time or sufficiently large reaction space, (b) intimacy of contact between the gas and liquid phase and (c) reduction of the absorption temp. especially originating in the  $\text{NH}_3$  combustion, through the method of introducing the hot combustion gases into the absorption app. and controlling the marked exothermal reaction of  $\text{HNO}_3$  from  $\text{N}_2\text{O}$ ,  $\text{O}_2$  and  $\text{H}_2\text{O}$ , the optimum conditions are discussed and the absorption chamber systems illustrated. At Bodio benzine was used to cool the  $\text{C}_2\text{H}_4$  used in freezing out the  $\text{N}_2\text{O}_4$  in Al tubes; the explosion resulted from the benzine becoming mixed with  $\text{N}_2\text{O}_4$  through a leakage of the tubes and the fact that, because of unusually hot weather, 50°, the mixt. was heated to its explosion pt. (cf. C. A. 16, 1368). The mixt. that exploded contained 4500 kg. of  $\text{N}_2\text{O}_4$  and 1500 kg. of benzine. At Zschorné with  $\text{C}_2\text{H}_4$  was used in place of benzine. A tabular presentation of explt. data on the life time of a mixt. of liquid  $\text{N}_2\text{O}_4$  and benzine alone and in the presence of Fe compds. and  $\text{H}_2\text{O}$  and with or without  $\text{C}_2\text{H}_4$  is made. Data are given for the explosive characteristics of  $\text{N}_2\text{O}_4$  and benzine mixts. in comparison with  $\text{C}_2\text{H}_4(\text{NO}_2)_2$ , explosive gelatin (92%  $\text{C}_2\text{H}_4(\text{NO}_2)_2$  and 8% collodion cotton) and a 65% gelatin dynamite. The benzine- $\text{N}_2\text{O}_4$  (1:5.06) mixt. ranked high in this comparison.

CHARLES E. MUNROE

**The trinitrotoluene isomers.** H. BRUNSWIG. *Z. angew. Chem.* 36, 75-6 (1923).—The m. p. of  $\alpha$  or 2,4,6- is 80.5°,  $\beta$  or 2,3,4- is 112°,  $\gamma$  or 3,4,6- is 104°,  $\delta$  or 3,4,5- is 137.5° (134°),  $\epsilon$  or 2,3,6- is 111° and  $\zeta$  or 2,3,5- is 97°. The "puffing off" temp. of 0.2 g. alone is  $\alpha$  290°,  $\beta$  302°,  $\gamma$  291°,  $\delta$  313°,  $\epsilon$  332° and  $\zeta$  335° but mixed, 0.25 g. with 0.05 of NaOH, it is for  $\alpha$  231°,  $\beta$  211°,  $\gamma$  194°,  $\delta$  252°,  $\epsilon$  249° and  $\zeta$  269°. The  $\gamma$  and  $\delta$  crystallize from MeOH in grains and each of the others in needles. Color reactions are given for each with  $\text{Na}_2\text{CO}_3$  or with PbO in boiling EtOH.

CHARLES E. MUNROE

**Explosions in apparatus for the liquefaction and fractionation of air.** F. POLITZER. *Z. angew. Chem.* 36, 262-6 (1923).—A resumé of accidents in the liquefaction of air, extending back to 1911, is given and special cases are discussed. They are found due to the presence of  $\text{C}_2\text{H}_2$ , or lubricating oil, or petroleum ether. The  $\text{C}_2\text{H}_2$  may be introduced with the original air at the intake. A delicate method for detg. the  $\text{C}_2\text{H}_2$  in the original, or the liquefied, air by means of ammoniacal  $\text{AgNO}_3$  is described and a vapor pressure curve for  $\text{C}_2\text{H}_2$  and  $\text{CO}_2$  is presented (cf. C. A. 17, 1147, 1551, 2192).

CHARLES E. MUNROE

**Delbroucks method of measuring percentages of firedamp in mine atmospheres.** ANON. *Iron Coal Trades Rev.* 106, 983 (1923).—A modification of LeChatelier's method is described which is accurate and more simple and does not require so delicate an app.  $\text{H}_2\text{O}$  is substituted for the Hg in the pressure gage. The app. serves both for collecting the sample and for burning the firedamp. Combustion is effected by means of an electrically heated spiral of Pt-Ir wire. Firedamp contents of 0 to 2% can be detd.

J. L. WILEY

**The extinction of mine fires by means of liquefied carbon dioxide.** C. L. JONES. *Coal Industry* 6, 272-9 (1923).—The principal function of  $\text{CO}_2$  in fighting mine fire is to prevent inward leakage of air by compensating for fluctuations of barometric pressure and by following up the contraction due to cooling.  $\text{SO}_2$ , N, and flue gases have been tried and the latter alone of these can compete with liquefied  $\text{CO}_2$ . Advantages of liquefied  $\text{CO}_2$  include: a great effectiveness, quick availability, and portability. Flue gases may be used successfully where: plenty of time is available between the decision and the application of gas, leakage is great, and where portability is of no consideration.

W. H. BOYNTON

Liquid oxygen in technical work (LÉPSIUS) 18. Industrial retting of mulberry [for nitrocellulose manufacture] (ROSSI) 24. Combustion of complex gaseous mixtures (PAYMAN, WHEELER) 21.

BROWN, HAROLD H. AND PRICE, D. J.: **Dust Explosions**. Boston: National Fire Protection Association. 3.

BRUNSWIG, HEINRICH: **Explosivstoffe**. 2nd revised ed. Leipzig: Joh. Ambrosius Barth. 215 pp.

**Explosives**. C. J. S. LUNDGAARD. U. S. 1,457,709, June 5. See Brit. 163,946 (C. A. 16, 165).

**Explosives**. H. RATHSBURG. Brit. 190,844, Oct. 20, 1921. The difficultly sol. salts of 1,3-dinitro-4,5-dinitrosobenzene, such as the K or Pb salt, are prep'd., in a finely grained and regular crystal form suitable for loading for blasting operations, etc., by treating picryl chloride with Na azide in aq. suspension and transforming the resulting dinitrodinitrosobenzene by means of alkali into the Na salt, which is then treated with a salt, such as acetate, nitrate, sulfate or chloride, of the metal corresponding to the salt desired, to obtain the required salt. *E. g.*, picryl chloride is treated with Na azide in aq. suspension for 1 hr. at 80-90° and for a further 3 hrs. at 90-100°. The picrylazide which is first formed splits off N to give the dinitroso comp'd. in well formed crystals. These are treated with soda and the mother lye is removed, the Na salt being then converted in the moist state by reaction with, *e. g.*, K acetate. By treating the solid Na salt a coarse-grained product is obtained.

**Diazodinitrophenol**. W. M. DEHN. U. S. 1,460,708, July 3.  $\text{NH}_4$  picramate is treated with concd.  $\text{HNO}_3$  in the presence of alc., under cover of a layer of neutral oil, to prevent combustion and explosion.

**Smoke-producing composition**. H. F. FRENCH and R. C. BENNER. U. S. 1,461,646, July 10. A non-explosive smoke-producing mixt. is formed of  $\text{Sb}_2\text{S}_3$  1-8, S 0.5-5,  $\text{NaNO}_3$  3-15, pitch 1 and  $\text{NH}_4\text{Cl}$  1-10 parts.

## 25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

**Spectrophotometric identification of dyes. I. Acid dyes of the Patent Blue type**. W. C. HOLMES. *Ind. Eng. Chem.* 15, 833-6(1923).—The degree in which the intensity of the absorption of solns. of dyes is modified by variations in concn., solvent, alky., acidity, and other conditions is dependent upon the degree of alteration of the dye in mol. form or aggregation, which, in turn, is conditioned upon constitutional differences. The quant. measurement of intensity of absorption under such variation in conditions, accordingly, affords spectrophotometric ratios, or consts., which have important diagnostic value for purposes of identification. An analytical scheme for the identification of acid blues of the Patent Blue type is outlined, in which such spectrophotometric ratios are employed to supplement the spectroscopic data customarily obtained. A comprehensive table of consts. for the identification of the dyes in question is supplied.

L. W. RIGGS

**Vat dyeing**. FRITZ PETERHAUSER. *Z. ges. Textilind.* 25, 196-7, 209-10, 220-1; *Chem. Zentr.* 1922, IV, 249.—The advantages of dyeing wool with vat dyes are emphasized; they are particularly lower temp., the short time (usually approx 0.5-1 hr.), the elimination of chrome-fixing necessary to other wool dyes, the increase in amt. of wool dyed in 1 operation, the protection of the quality and elasticity of the wool, the high degree of fastness and the saving in steam. The causes of whitening of indigo-blue fabrics when rubbed are explained and directions given for dyeing to a given standard.

C. C. DAVIS

**The application of vat dyes in cotton dyeing**. ARTHUR BUSCH. *Z. ges. Textilind.* 25, 255-6; *Chem. Zentr.* 1922, IV, 318.—Data on the preliminary treatment of yarns and details of dyeing.

C. C. DAVIS

**Effect of hydrogen-ion concentration on adsorption of dyes by wool and mordants.—Preliminary paper**. O. REINMUTH AND N. E. GORDON. *Ind. Eng. Chem.* 15, 818 (1923).—The marked change of adsorption with a small change in  $p_{\text{H}}$  value proves that a control of H-ion concn. is a most important factor in the dye industry. There is also a decided change of color with a change of  $p_{\text{H}}$ .

L. W. RIGGS

**Dyeing of textile fibers for the hosiery trade**. F. ASQUITH. *Am. Dyestuff Rept.* 12, 500-5(1923).—A general outline of the process is given including a selection of colors for animal fibers, cotton and artificial silk.

L. W. RIGGS

**Verification of the antioxygenating power of the polyatomic phenols. Relation between the fastness to light of dyes on the fiber and the presence in their molecules**

of *o*- or *p*-diphenol. ALFRED GILLET. *Compt. rend.* 176, 1402-5 (1923); cf. Moureu and Dufraisse, *C. A.* 16, 1439, 3737; 17, 1951, 1958, 2105.—Outside of dyes from pyrazolone, and dyes for cotton which have been made fast by treatment with Cu salts, the best fastness to light of dyes on the fiber is intimately connected with the presence in the mol. of the sufficiently stable *o*- or *p*-diphenol function. The designation of phenol function is extended to characterizing groups with an energy value approx. that of OH such as  $\text{—N=N—Ar}$ ,  $\text{HN—Ar}$ ,  $\text{HN—Ac}$ ,  $\text{—O—Ar}$ ,  $\text{—SH}$ ,  $\text{—SAr}$ , etc. These radicals in *o*- or *p*-positions confer the same antioxygenating qualities as the OH of pyrocatechol or hydroquinol. Application of the antioxygenating power of polyphenols: Increase of fastness to light of the dyes on fiber. ALFRED GILLET AND FERNAND GIOT. *Ibid* 1558-60.—Fibers dyed with fugitive colors were treated with a diphenolic soln. and the fastness was observed. Summary: All azo compds. suitable for dyeing with acid, wool or cotton, are relatively protected against the action of air under the influence of light, by the function *o*- of *p*-diphenol whether or not this forms a part of the mol. of the dye. It is the same for certain strongly acid dyes such as those of the eosine group. The nitro dyes are not protected. Without doubt the photochem. reaction which changes nitro dyes is other than autoxidation (reduction or neutralization?). It may be said of the triphenylmethane dyes that they are basic, or that they dye with acid; their decoloration is not by an oxidation. Basic colors are not protected. This is explained if it is admitted that the medium (fiber dye) is a basic residue. Hydroquinol accelerates autoxidation in a basic medium, thus an alk. hyposulfite soln. is oxidized 30 to 40 times more quickly on the addn. of hydroquinol. With eosine and brilliant congo more than 6 mol. of hydroquinol are necessary to protect 1 mol. of the dye. For complete antioxygenating enough diphenol should be added to act on the dye and on the dyed fiber. L. W. RIGGS

Application of antioxygenators to dyestuffs. The antioxygenating power of cuprous salts explains the increase in fastness to light caused by the use of such salts with certain dyes on the fiber. ALFRED GILLET AND FERNAND GIOT. *Compt. rend.* 176, 1894-5 (1923).—The object was to det. if the protection of the color is due to the antioxygenating power of cuprous salts proceeding from the reduction of the cupric salt by the dyed fiber. Five samples of cotton were dyed with blue diamine 2B; the first served as control, the 2nd was impregnated with a mixt. of equal parts of a 10% soln. of  $\text{CuSO}_4$  and a satd. soln. of  $\text{SO}_2$ , the 3rd with a soln. of  $\text{CuSO}_4$  alone, the 4th with a soln. of  $\text{SO}_2$  alone, and the 5th with a 2% soln. of hydroquinol. One-half of each cotton sample was exposed to light. After 10 days in June the control sample was much faded, the samples treated with  $\text{CuSO}_4$  and  $\text{SO}_2$  separately were a little less faded, the sample treated with  $\text{CuSO}_4 + \text{SO}_2$  was "practically perfect" and better in fastness than the sample treated with hydroquinol. The protection of blue diamine 3B under the same conditions is complete. Several other colors were tested. L. W. RIGGS

Color fastness in linen fabrics. KARL STEFAN. *Z. ges. Textilind.* 25, 232-3; *Chem. Zentr.* 1922, IV, 249.—Colors fast to washing and boiling can be obtained in linen fabrics with indanthrene dyes. These dyes are suitable for medium and fine shirtings, and washable good of various kinds, as well as for fancy fabrics with different shades in warp and weft. C. C. DAVIS

Common acid yellows and oranges. Properties and uses. GEORGE H. JOHNSON. *Am. Dyestuff Rept.* 12, 487-91, 513-6 (1923).—The following named dyes are briefly described as to their chem. constitution, uses, and the results likely to be obtained with reference to levelling power, fastness to light, alkalies, washing, acids, stoving, carbonizing, steaming, rubbing and milling, when these dyes are used: Quinolin Yellow, Xylene Yellow 2G, Naphthol Yellow, Tartrazine, Fast Light Yellow G, Fast Yellow G, Metanil Yellow, Azo Yellow or Curcumeine, Supramine Yellow G and R, Tropaeoline, Orange GG, Orange IV, Sulphon Orange 5C, Croceine Orange G, Orange II, and Orange R. L. W. RIGGS

Testing the "brittleness" of textile fibers. P. KRAIS. *Text. Forsch.* 4, 96-9; *Chem. Zentr.* 1922, IV, 1060.—The test is carried out by a striking app. connected with an adjustable striking load. Av. values for various fibers are given. C. C. DAVIS

Wastes from the textile industry in Russia. W. DROSZDORF. *Gesundh. Ing.* 46, 167-8 (1923).—Textile wastes are divided into 2 groups: those from wool, fabric, and silk industries, and those from the cotton, linen, and hemp industries. The wastes from the first group contain dyes, org. nitrogenous material, and pathogenic bacteria. Those from the second group contain org. matter, a small amt. of org. nitrogenous material,  $\text{NH}_4$ , and suspended matter in small concns., with no dissolved poisons. These wastes can be purified by the usual chem. means: lime; lime and  $\text{FeSO}_4$ ; combined chem. and mech. means, etc. Biological means, however, offer the only method of complete puri-



fication; recent investigations point to excellent results along this line.

MARTIN E. FLÉNTJE  
**The influence of light on textile fibers.** P. WAENTIG. *Z. angew. Chem.* **36**, 357-8 (1923).—Individual fibers were acted upon by artificial light of known and reproducible intensity (quartz-Hg lamp), under controlled conditions, tested for elasticity and tensile strength, and thus compared with fibers that had not been so treated. Individual differences in results were so great that a large number of tests had to be made to obtain data of value. Wool poor in fat (washed) was more sensitive to light than that richer in fat, and wool was considerably less sensitive to ultra-violet light than silk and cellulose fibers. The effect of light upon silk was limited to the short ultra-violet rays that could not pass through glass. Tests with exposure of wool to sunlight were made: but little change in the properties of the fibers was noticed. Even the assumption that lamb's wool is especially sensitive to light was not confirmed. Cotton, linen and mercerized cotton are sensitive to light. Viscose silk, nitro silk and "copper silk" are not nearly so strongly affected, whereas acetate silk shows considerable sensitiveness. Thus, whereas Buenos Aires wool showed 12.0 g. tensile strength and 45% elasticity before illumination, 11.7 g. and 42% after illumination with Hg-quartz lamp, and 11.0 g. and 45% after treatment with sunlight. Egyptian cotton showed a tensile strength of 7.2 g. when unilluminated, 3.0 g. when illuminated directly by Hg-quartz light for 24 hrs., 7.5 g. when so illuminated through glass, 7.3 g. when through "Uviol" glass, and 4.0 g. when through quartz.

W. C. EBAUGH  
**The bleaching of textile goods.** EMIL KIRCHHEIS. *Z. ges. Textilind.* **25**, 266-7, 276-7; *Chem. Zentr.* **1922**, IV, 500.—Detailed information on sizing, singeing, moistening, freeing from sizing, first-washing, bucking, treating with bleaching liquor, acidifying, washing and drying.

C. C. DAVIS  
**The acid chlorine bleaching process.** F. RISTENPART. *Am. Dyestuff Rept.* **12**, 510-2 (1923).—See C. A. **17**, 2055.

E. J. C.  
**The action of dilute sulfuric acid on artificial silk.** W. ZÄNKER AND HANS SCHREIBER. *Textilchem. Col.* **1923**, 85-9.—An increased textile strength rather than the expected disintegration resulted when skeins of artificial silk were squeezed out of very dil.  $H_2SO_4$  and dried. The max. increase of 9.16% was found in a  $CuO-NH_3$  silk, when 0.0625  $N$   $H_2SO_4$  was used, and 9.24%, the max., was realized when 0.0469  $N$  acid was used on a viscose silk. The drying is not carried to the point of complete loss of moisture.

E. R. CLARK  
**Application of ammonia gas to silk reeling.** RYUGO INOUE AND SHIGERU KURAHARA. *J. Sci. Agr. Soc. (Japan)* No. **244**, 1-32 (1923).—Since silk-reeling is controlled by soly. of sericin in the cocoon, the soly. of this is first studied. Sericin of the outer layer is more sol. than that of the inner layer. The N contents of these two layers are given. The silk reeling curve after application of  $NH_3$  gas was obtained. Since  $NH_3$  treatment increases sol. N of cocoon it raises the curves, lowers temp. necessary to boil the cocoon and increases the amt. of reeling per unit time, without affecting elasticity and strength and slightly improves luster. The optimum amts. of the gas to be used are: For 5-10 min. treatment in sealed vessel, 0.003-4 g. per 100 cc.; for a longer time (with cover), 0.0025-35 g. per 100 cc. The product treated by this gas shows no trace of  $NH_3$  and the silk is free from any undesirable effect. NII, in concn. of 50/10,000 will not dissolve fibroin even on boiling for 30 min.

S. T.  
**The quality of artificial silk.** A. HERZOG. *Text. Forsch.* **4**, 99-100; *Chem. Zentr.* **1922**, IV, 1023.—A valuable criterion for judging the fineness and other com. properties is the relation between the width of the individual fibers and their cross-sectional area. A formula is derived.

C. C. DAVIS  
**Behavior of bast fibers under the influence of caustic alkalis.** C. R. NODDER AND R. W. KINKAD. *J. Text. Inst.* **14**, 133-56T (1923).—The methods of testing are described and the results are shown in 5 charts of curves and 2 plates of photomicrographs. Summary: "The percentage contraction produced by NaOH solns. of various strengths in (a) single flax and ramie fibers, and (b) flax and ramie yarns has been investigated, and the curves obtained have been discussed. The twisting behavior of ramie and flax fibers during mercerization has been observed. The bearing of the results on the production of a high degree of luster upon materials composed of bast fiber has been pointed out. The existence of certain relationships between the mol. compn. of NaOH solns. and their action on vegetable fibers has been discussed."

L. W. RIGGS  
**Experiments on the quantitative determination of the capacity for wetting of wetting agents.** W. VON HERBIG. *Z. ges. Textilind.* **25**, 221-2, 230-2; *Chem. Zentr.* **1922**, IV, 269.—A process is described for dipping, centrifuging and weighing skeins of yarn.

Expts. with  $H_2O$ , soap, Turkey red oil, Turkey red oil with tetracarnite, tetracarnite alone, etc. showed that tetracarnite was the most effective. The wetting capacity of tetracarnite solns. increased with the concn. C. C. DAVIS

**Dyeing experiments with degummed flax and hemp compared with cotton.** P. KRAIS. *Text. Forschg.* 4, 101; *Chem. Zentr.* 1922, IV, 1022.—Degummed flax and hemp can be safely dyed in mixed yarns contg. each, or in yarns contg. either one mixed with cotton. Direct dyes and basic dyes give somewhat brighter colors on degummed flax than on cotton. Degummed hemp is dyed more strongly than degummed flax. The fastness toward washing of degummed flax which is dyed is the same as cotton dyed with the corresponding dyes. C. C. DAVIS

**The differentiation of flax and hemp by optical means.** A. HERZOG. *Text. Forschg.* 4, 58-61; *Chem. Zentr.* 1922, IV, 558.—On testing fibers in the polarization microscope, interference colors appear in the orthogonal position, which are different for flax and for hemp. This serves as a method for distinguishing flax and hemp in bleached goods, where other methods are difficult. C. C. DAVIS

**The determination of flax and cotton in mixed fabrics.** A. HERZOG. *Text. Forschg.* 4, 55-8; *Chem. Zentr.* 1922, IV, 558.—Data are on given sorting and counting processes. C. C. DAVIS

**The problem of the constancy of the quantitative relations of linen and cotton threads in semi-linen fabrics.** J. M. CHAILLOW AND S. S. DROSDOW. *Ber. Polytechnikum Iwanowo-Wosniezensk.* 6, 219-20; *Chem. Zentr.* 1922, IV, 269.—Raw flax and cotton threads mixed in various relative amts. are proved to retain the same proportions in the fabrics spun from the mixts. C. C. DAVIS

**The elongating action of wool fibers.** P. KRAIS. *Text. Forschg.* 4, 71-2; *Chem. Zentr.* 1922, IV, 556.—The "flowing" of wool fabrics is described. C. C. DAVIS

**Chemical properties of cotton linters.** WM. F. HENDERSON. *Ind. Eng. Chem.* 15, 819-22(1923).—By treating cotton with strong acids it was found that the Cu nos. were increased considerably as long as the acid concns. were low, but very rapidly when the acid concns. were high. With weak acids the change in Cu nos. was slight for all concns. When the linters were treated with alkalis, the Cu nos. remained practically const. Various methods for prepg. viscose from linters were tried. Preliminary acid treatment of the linters produced a marked effect upon the viscosity of the viscose solns. The effect upon the viscosity was much more pronounced than that on the Cu nos. L. W. RIGGS

**The moisture content and the problem of the conditioning of jute.** P. KRAIS. *Text. Forschg.* 4, 51-2; *Chem. Zentr.* 1922, IV, 556.—Changes in the weather are accompanied by changes in the yarn. The figure of 12.09% variation given in text and reference books is too low. A reliable detn. of the  $H_2O$  content is difficult. C. C. DAVIS

**Colloidal solutions of fatty acid salts of aluminium.** H. POMERANZ. *Z. ges. Textilind.* 25, 277-8; *Chem. Zentr.* 1922, IV, 387.—Colloidal aq. solns. of Al soaps, which can be prepd. by ordinary methods, are of advantage as waterproofing agents, and are applicable in dyeing. C. C. DAVIS

**Use of latex in waterproofing.** A. H. HARD. *Textile World* 63, 3495-9(1923).—Cloth treated with several coats of undiluted latex and soaked in water for several days appears to offer advantages over the vulcanized product and suggests a new method of waterproofing and duplexing cloth. CHAS. E. MULLIN

The practical application of sulfurized oil (PUXMSP) 27. The industrial retting of the mulberry (ROSSI) 23. Dyes derived from phenanthraquinone (SIRCAR, SIRCAR) 10.

BURATTI, ROMOLO: *Chimica delle fibre tessili e dei loro trattamenti industriali. Note di chimica tessile ed affine.* Milan: L'Industria tessile e tintoria. 395 pp. L. 25.

CAIN, JOHN CANNELL AND THORPE, JOCELYN FIELD: *The Synthetic Dyestuffs and the Intermediate Products from which they are derived.* 6th Ed. London: Charles Griffin & Co., Ltd. 423 pp. 21s. net.

COOPER, F. J.: *Textile Chemistry: An Introduction to the Chemistry of the Cotton Industry.* London: Methuen and Co., Ltd. 235 pp. 10s. 6d.

FRIEDLANDER: *Fortschritte der Teerfarbenfabrikation.* Vol. XIII. January 1, 1916 to July 1, 1921. New York: Lemcke & Buchner. \$36.

RAUSCH, CHARLES: *Verschiedene Appretur-Verfahren speziell über Appret-*

Chimique, Lyoner-, Schweizer- und Spezial-Apprets. Leipzig: 3 (Bayerschestr. 61). G. Leuze. 63 pp.

Bituminous clay emulsion (for impregnating textiles) (U. S. pat. 1,461,445) 22.

**Triarylmethane dyes.** G. DE MONTMOLLIN, J. SPIELER and G. BONHOT. U. S. 1,460,315, June 26. Dyes are prepd. by reaction between an arylchloroform and  $\alpha$ -naphthol-2-carboxylic acid in the presence of a catalyst and an acid-fixing reagent, *e. g.*, NaOH in aq. soln. The dye from phenylchloroform dyes wool gray tints turning to fast green on chroming.

**Gray mordant dye.** YOSHITAKA CHIYONOBU and KUNIZO HARA. Japan. 41,526, Jan. 27, 1922. Half a part of S chloride is gradually added to 1 part of  $\text{PhNH}_2$  under cooling, 6-7 parts of  $\text{H}_2\text{SO}_4$  of 86° Bé. are added and the mixt. is heated at 140-70° on an oil bath. When the mass becomes black, it is cooled and then thrown into  $\text{H}_2\text{O}$ ; the ppt. is filtered, washed and mixed with an alkali until a light blue color is produced. The dye colors wool grayish blue and silk pale blue with Cr salts as a mordant. The colors are resistant to light,  $\text{H}_2\text{O}$ , acid and alkali.

**Acid yellow mordant dye.** YOSHITAKA CHIYONOBU and KUNIZO HARA. Japan. 41,525. Jan. 27, 1922. A purple compd. is produced by gradually adding 0.5 part of S chloride to 1 part of  $\text{PhNH}_2$  under cooling, and then adding 7 parts of concd.  $\text{HNO}_3$  contg. small amt. of concd.  $\text{H}_2\text{SO}_4$ . The mixt. is warmed on a water bath and a large amt. of fuming or concd.  $\text{HNO}_3$  is added until the mass becomes golden yellow; the product is then thrown into cold  $\text{H}_2\text{O}$ . The ppt. thus produced is filtered, washed with  $\text{H}_2\text{O}$  and dried. A 0.5% soln. of the dye colors wool and silk deep yellow with  $\text{K}_2\text{Cr}_2\text{O}_7$  as a mordant. The color is resistant to light,  $\text{H}_2\text{O}$ , acid, and alkali.

**Dyeing furs, feathers or hair.** O. KALTWASSER and L. KIRBERGER. U. S. 1,460,758, July 3. A soln. of 2,7-dihydroxynaphthalene is used together with an oxidizing agent such as 3%  $\text{H}_2\text{O}_2$  soln., for dyeing gray or greenish gray.

**Dyeing cellulose acetate.** BURGESS, LEDWARD & Co., LTD. and W. HARRISON. Brit. 190,313, Oct. 29, 1921. Cellulose acetate goods are dyed by means of alkyl-aminoazo compds. contg. no sulfonic nor carboxylic acid groups. Suitable dyes are those prepd. by coupling methylaniline or dimethylaniline with the diazo compds. of aniline, chloroanilines, nitroanilines, aminomethylanilines, aminodimethylaniline, naphthylamines, or aminoazobenzene, or with the tetrazo compds. of benzidine, dianisidine, or diaminodiphenylmethane. The dyes may be dissolved in HCl, or preferably they are dissolved in HOAc or  $\text{H}_2\text{CO}_3$  and mixed with  $\text{H}_2\text{O}$  and a protective colloid. According to the Provisional Specification, aminoazo compds. or arylaminoazo compds. may be employed, *e. g.*, aminoazotoluene, aminoazonaphthalene, aminoazonaphthols, or aminoazonaphthylamines. Cf. 182,830 (C. A. 16, 4356).

**Apparatus for bleaching or dyeing skeins of thread.** M. SANTALO. U. S. 1,461,330, July 10.

**Balloon fabric.** C. A. CLEGHORN. U. S. 1,460,053, June 26. Two sheets of thin textile fabric are placed face to face after one of the sheets is coated with a mixt. of "birdlime," diatomaceous earth and shellac and the other with rubber. One of the outer surfaces of the composite sheet may also be rubber-coated.

**Hollow textile fibers.** J. ROUSSET. Brit. 189,973, Nov. 15, 1921. See U. S. 1,427,330 (C. A. 16, 3763).

**Artificial threads; viscose.** E. BRONNERT. Brit. 190,772, Sept. 20, 1921. Addn. to 170,024 (C. A. 16, 1016). In the manuf. of very fine threads from raw viscose by the draw-spinning process of the principal patent, a coagulating bath of a modified compn. is employed; it consists of a soln. contg. about 100 g. of  $(\text{NH}_4)_2\text{SO}_4$  satd. with respect to Na or Mg sulfate or both, and contg. a proportion of  $\text{H}_2\text{SO}_4$  adjusted according to the principle formulated in the principal patent, the proportion of  $(\text{NH}_4)_2\text{SO}_4$  being regarded as equiv. to half its wt. of  $\text{H}_2\text{SO}_4$ , and the Na or Mg sulfate being neglected.

**Finishing fabrics.** STEVENSON, McKELLAR & Co., LTD. and J. McHAFFIE. Brit. 189,968, Nov. 14, 1921. Textile fabrics are treated with KOH or NaOH soln. of about 10% or 23° Tw., and then for a period of 15 min. to 2 hrs. with  $\text{CCl}_4$  or  $\text{CS}_2$  for producing a combining effect between the fabric and the alkali. The fabric is then passed through a fixing bath of  $\text{H}_2\text{SO}_4$  of 2° Tw. and is finally treated with concd.  $\text{H}_2\text{SO}_4$  of 120-40° Tw. till a transparent effect is obtained.

**Retting, degumming, and treating vegetable and animal fibers.** N. KIDGER and J. HARRIS. Brit. 190,198, May 15, 1922. In the degumming or like treatment of vegetable fibers such as china grass (ramie), flax, etc., and the degreasing of wool, silk and other animal fibers the material is boiled in an open tank in the presence of soap,

with, if desired, the addn. of a small quantity of paraffin, and  $H_2O$  is then admitted to the bottom of the tank to cause the sepd. resinous and vegetable matter to pass away through an overflow outlet. After a further boiling, a small quantity of gasoline, benzene, or the like, is admitted, and boiling is continued until digestion is completed; fresh  $H_2O$  is then admitted at the bottom to wash away by overflow, resin, gasoline, etc., floating on the top, and the fibers are removed from the tank in the usual way.

**Beetling piece fabrics.** R. W. R. MACKENZIE, E. H. ROBINSON, M. FORR and J. D. LUMSDEN. U. S. 1,460,858, July 3. Piece fabrics formed of cotton, linen or other vegetable fibers are treated with benzine or other solvent to remove oils, fats, waxes and resins, and then beetled.

**Yarn-tensioning devices.** J. O. MCKEAN. U. S. 1,461,536, July 10. Tension disks of hard fiber are used on stop motion devices. U. S. 1,461,537 specifies tension disks with yarn contact surfaces of Pb or similar soft metal.

## 26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

**Relation between the brightness and hiding-power of white paint pigments.** A. H. FRUND. *J. Franklin Inst.* 196, 69-78(1923).—Within the brightness range 75 to 85%, the ratio % increase in hiding power: % decrease in brightness equals 5.0 for all white paints. At complete hiding, a gray paint film is far more transparent than a corresponding white film. Opacity measurements must be used with caution in drawing conclusion relative to hiding power.

**Oil paints.** A. EIBNER. *Bayer. Ind. Gewerbeblatt* 64, 105-6, 109-10, 113-4, 117-9 (1922).—The known fact that a slow-drying oil paint varies in its rapidity of drying according to the nature of its undercoat is due to the siccative effect of the undercoat. For all practical purposes, no fatty oils can be called non-drying, since olive and almond oils dry in a few weeks when applied on undercoats of red lead and poppy-seed oil, no softening taking place subsequently in several years. Synthetic triolein dries in a few weeks on a lead plate. Mulder's view that glycerol is liberated from fatty oils during drying is untenable, since linseed and poppy-seed oil films yield glycerol to the full amt. demanded by theory. All double bonds become satd. on prolonged drying, the fatty peroxides acting as both intra- and extra-mol. O carriers. No yellowing of linseed oil films occurs in darkness or in dry air, but moist air strongly favors its development. Films of free linolenic acid become yellow on drying, subsequently soften and actually become brown, while films of linseed oil fatty acids do not behave thus. The yellowing of linseed oil films is thus a particular effect of free linolenic acid (produced by aq. hydrolysis) or its peroxide. A table showing the increases of acid values in fatty oil films is appended.

J. S. C. I.

**Seeds of Sang Mau Bung.** G. VERNET AND NGUYEN-VAN-LONG. *Bull. agr. inst. sci. Saigon* 2, 287-9(1920); *Bull. Agr. Intelligence* 12, 72.—No substance was obtained from the ripe dried seeds of the Sang Mau Bung (*Horsfieldia irya*) by either hot or cold pressing. Alc. (90%) readily extd. a resin, m. 120°, which was quite suitable for the manuf. of varnish for wood and leather.

JOSEPH S. HEPBURN

**Aggregation and disaggregation.** Hydrolysis of shellac resin (HARRIES) 2. Leather (varnish for) (Brit. pat. 189,942) 29. Sulfonation products from gilsonite (U. S. pat. 1,459,328) 22.

COFFIGNIER, CH.: **Varnishes, Their Chemistry and Manufacture.** Translated from the French by A. H. J. KEANE. London: Scott, Greenwood & Son. 548 pp. 21s.

**Pigment for paints.** H. S. BLACKMORE. U. S. 1,460,699, July 3.  $H_2O$ -sol. aluminates and sulfates which react together to form insol. aluminate and insol. sulfate, e. g., Ba aluminate and  $ZnSO_4$  or  $MgSO_4$ , are employed for the manuf. of pigments.

**Drier or filler for paints.** G. E. HUGHES, SR. U. S. 1,459,739, June 26. Glue is heated with linseed oil, the residue of the glue is sepd. from the oil and mixed (with or without previous heating with kerosene) with resin and  $PbO$ . The mixt. is heated above the m. p. of the resin, the product is allowed to cool and then ground.

**Oil mixture for paints.** G. E. HUGHES, SR. U. S. 1,459,732, June 26. An oil mixt. for paints is prepd. by heating linseed oil with glue in the proportion of 1 lb. glue

per gal. of oil, until action ceases, removing the glue, soaking it in  $H_2O$  to soften it, heating the resulting jelly-like mass with kerosene in the proportion of 1 lb. per gal. of kerosene and then mixing the treated linseed oil with the treated kerosene. The mixt. thus obtained produces a paint or varnish film of good durability on various materials.

**Varnish.** W. E. SMITH, R. C. L. HODGES and F. J. CLEMENTS. Brit. 189,967, Nov. 14, 1921. A varnish, suitable for violins, is made by mixing  $1/4$  lb. of powd. gum copal and  $1/2$  lb. of black Sb ( $Sb_2S_3$ ) with 1 pt. of rectified spirits of wine, allowing the mixt. to stand, and decanting off the clear liquor.

## 27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

**Artificial fats and fatty acids.** REX FURNESS. *Chemistry and Industry* 42, 358-61 (1923).—A review.

**Dry rendering of fats.** J. P. HARRIS. *Chem. Met. Eng.* 29, 93-6 (1923).—The material is hashed and charged into a rotary fat melter, which consists of a steam-jacketed horizontal rendering kettle provided with a mech. agitator, whereby the fat is kept in violent and even agitation, the fat being sepd. meanwhile from the tissue and bone by the application of 60 lb. steam pressure to the jacket. After sepn. is complete (the kettle contents being simultaneously dried), the discharge door is opened and the contents are discharged into the fat percolator, which consists of a shallow cone-bottomed tank, so arranged that the rendered fat percolates through to storage, while the solids are retained but are afforded such opportunity of draining that they are dry enough to be fed directly to an Anderson expeller, from which the hard dry cracklings are discharged in cake form. The av. % of fat left in the cracklings is from 5 to 8%. This method of handling gives a superior finished product in 6 to 7 hrs. as against 48 to 72 hrs. by the wet rendering process.

E. SCHERUBEL

**New method for the analysis of oils and fats.** L. REUTTER. *J. pharm. Belg.* 5, 341-343 (1923).—To a mixt. of various vegetable oils were added some Carnauba wax, spermaceti, nutmeg fat and laurel oil. Of this mixt. 200 g. was saponified with KOH on a water bath. A soap B and a filtrate A were obtained. A was treated with NaCl and the ppt. filtered off. The filtrate was evapd. to dryness under reduced pressure. The residue was treated successively with: (1)  $H_2O$ , which takes up the glycerol, identified by its naphthylurethan, m.  $279^\circ$ ; (2) petroleum ether, which takes up cetyl, ceryl, carnaubic and myricyl alcohols, cholesterol and phytosterol. The soln. was evapd. and the residue again treated with petroleum ether. The ethereal soln. was allowed to evap. spontaneously and then fractionated to obtain cetyl alc., m.  $49^\circ$ , carnaubic alc., m.  $68^\circ$ , myricyl alc., m.  $88^\circ$ ; (3) EtOH, which exts. the cholesterol and phytosterol. These were sepd. by fractional crystn. in the presence of EtOH. The NaCl ppt. was decomposed with HCl in the presence of ether and shaken out with  $H_2O$  to obtain formic, acetic, propionic and valeric acids. The EtOH soln. was evapd. to dryness, the residue neutralized with alc. KOH in the hot and fractionally distd. The residue was treated with (a) boiling  $H_2O$ , then with boiling  $(CH_3)_2CO$ . Soln. (a) was treated with HCl in the presence of ether, which liberates lauric and arachic acids. The acids were pptd. as the Ca salts, the lauric acid salt being sepd. by soln. in boiling  $H_2O$  and the arachic acid salt by soln. in boiling EtOH. Soln. (b) was evapd. to dryness and the residue decomposed with HCl in the presence of EtOH, which liberates valeric, caprylic, capric and caproic acids. By spontaneous cryst. capric acid, m.  $31^\circ$ , was obtained. Valeric, caproic and caprylic acids were pptd. from the mother liquor with  $AcOAg$ . The valeric acid salt was sepd. from the ppt. by extn. with boiling  $H_2O$ . B was dried, decomposed with HCl in the presence of EtOH, and allowed to crystallize spontaneously. A semi-solid portion I and a filtrate II were obtained. I was treated with  $BaCl_2$  in the presence of  $NH_3$  and the ppt. collected and dried. The residue was extd. with benzene contg. 5% of EtOH, which dissolves out the Ba oleate, leaving behind the Ba salts of linolenic and linoleic acids. The Ba oleate was decomposed with HCl and the oleic acid identified by its m. p.  $14^\circ$ . The residue contg. linolenic and linoleic acids was decomposed with HCl in the presence of EtOH, the soln. concd. and Br added to a brown color in the presence of benzene and AcOH. The crystals which formed were treated with Et<sub>2</sub>O contg. some EtOH and the soln. on spontaneous evapn. yielded linolenic acid tetrabromide, m.  $114^\circ$ . The linoleic acid hexabromide, m.  $170^\circ$ , insol. in the Et<sub>2</sub>O-EtOH mixt., was recrystd. from boiling benzene. II was taken up with Et<sub>2</sub>O, treated with alc. KOH, evapd. to dryness and the residue treated with boiling  $(CH_3)_2CO$ . A

filtrate (1) and a residue (2) were obtained. (1) was concd. and treated with HCl in the presence of  $\text{Et}_2\text{O}$ . The  $\text{Et}_2\text{O}$  soln. was concd. and Li acetate added. The ppt. was dried and treated with  $\text{EtOH}$ , which takes out the Li myristate. This was decomposed with HCl in the presence of  $\text{Et}_2\text{O}$  and the myristic acid, m.  $53^\circ$ , allowed to crystallize spontaneously. The residue from the  $\text{EtOH}$  extn. was decompd. with HCl in the presence of  $\text{Et}_2\text{O}$ , the clear soln. decanted and concd., and Pb acetate added. The ppt. was dried and treated with petroleum ether and then boiling benzene, which takes up Pb stearate but not the palmitate. The Pb salts were decomposed with HCl in the presence of  $\text{Et}_2\text{O}$  and allowed to crystallize spontaneously. Palmitic acid was identified by its m. p.,  $62^\circ$ , and b. p.,  $268^\circ$ ; stearic acid by its m. p.,  $69.3^\circ$ , and b. p.,  $291^\circ$ . (2) was treated with  $\text{EtOH}$ , which exts. the K salts of erucic, crotonic, melissic, cerotic, carnaubic, tiglic, ricinolic and margaric acids. These salts were decomposed by treating with HCl in the presence of  $\text{Et}_2\text{O}$  and Zn acetate was added. This yielded a ppt. (a) and a filtrate (b). (a) was dried and decompd. with HCl in the presence of benzene. The benzene soln. was treated with Pb acetate, the ppt. dried and treated successively with petroleum ether, which exts. the Pb salt of erucic acid; then with boiling benzene, which exts. the Pb salts of tiglic and crotonic acids. (b) was concd. and the residue decompd. with HCl in the presence of  $\text{Et}_2\text{O}$ . The  $\text{Et}_2\text{O}$  soln. was treated with Pb acetate. The dried ppt. was treated first with  $\text{CHCl}_3$ , which exts. the Pb salt of melissic acid, then with hot  $\text{EtOH}$ , which exts. the Pb salt of lignoceric acid, finally with boiling benzene. The benzene soln. was treated with HCl and subjected to fractional crystn. It deposited carnaubic acid, m.  $72^\circ$ , and cerotic acid, m.  $82^\circ$ .

A. G. DUMÉZ

**Color of Oil and Meal Committee (A. O. C. S.) report, 1923.** D. WESSON. *Cotton Oil Press* 7, No. 2, 33-4 (1923).—It is impracticable to secure immediately any instrument to replace the Lovibond glasses; therefore a tintometer using artificial light and standard color tubes has been devised. This has been used by the committee with favorable results. The "Daylight" lamp is not quite const. and must be renewed from time to time; a means should be provided for removing the tubes, and a prism to give a divided field instead of 2 sep. color fields might be advantageous. The E-K Colorimeter (C. A. 16, 4358) has been perfected and further comparisons on the readings of oil with this and the Lovibond glasses are to be made next year. It is suggested all glasses be standardized against the E-K instrument.

H. S. BAILEY

**Composition of oil cakes.** KHR. I. KYULYUMOV. *Rev. inst. recherches agron. Bulgare* 2, No. 304, 249-54 (1922).—Sunflower oil cakes show an oil content of 8 to 20% and 20 to 40% of protein. Small plants erected during the war are very primitive and leave too much oil in the cakes.

E. SCHERUBEL

**Variation of refractive index of china wood oil with temperature.** F. H. RHODES AND H. E. GOLDSMITH. *Ind. Eng. Chem.* 15, 786 (1923).—The  $n$  of China wood oil decreases 0.000395 for each increase of  $1^\circ$  in temp.

E. SCHERUBEL

**Surface tension of alkaline soap solutions.** E. B. MILLARD. *Ind. Eng. Chem.* 15, 810-11 (1923).—The substances which produce the greatest decrease in surface tension are the most efficient detergents and the cleansing power of these "addition agents" can be measured in this way. M. detd. the interfacial tension of various soap solns. against benzene by measuring the drop vol., comparing the ideal drop vol. with such a soln. Surface-tension measurements show that excluding  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$  is most effective for reducing surface tension. A modified soda made by mixing  $\text{NaHCO}_3$  with  $\text{Na}_2\text{CO}_3$  is less effective than the  $\text{Na}_2\text{CO}_3$  it contains. The use of  $\text{NaOH}$  is not to be recommended on account of its weakening effect upon the cotton.

E. SCHERUBEL

**The practical application of sulfurized oil.** ED. PUXMEP. *Z. ges. Textilind.* 25, 305-6; *Chem. Zentr.* 1922, IV, 554.—A description of the uses of the oil as a textile oil and in the hat dyeing, sizing and leather industries and in Turkey red oil soaps.

C. C. D.

**The lathering of soap.** W. KIND AND F. H. ZCHACKER. *Textilber.* 4, 277-84 (1923).—A semi-popular illustrated description of the principle factors in suds formation. Sulfonated oil, saponin, gum tragacanth, and clay do not add to the stability of lathers.

E. R. CLARK

**Valuation of oxygen washing compounds.** KURT BRAUNER. *Chem.-Ztg.* 47, 551-4, 578 (1923).—Sunlight soap, Thompson's washing powder and "Persil" an active O compd. contg. soap, soda, and perborate, were compared in a series of tests. Mineral, animal and vegetable oils were emulsified with a 1% soln. of each of the detergents by boiling for 15 min., allowing to stand 5 min. and observing the amt. of sepn. A table shows results. A 2nd test was made by impregnating pieces of cloth with various oils and then boiling them for 15 min. in a 1% soln. of the washing materials. After boiling the cloth was rinsed, dried and the oil extd. with ether. The same test was repeated at a temp. of  $40^\circ$ . The results of the two tests were practically the same and are tabulated.

A 3rd test was made using cloths which were specked with cocoa, coffee, wine, oil, milk, blood, rust and ink. The results indicated "Persil" first in effectiveness, then the soap, and washing powder. A practical laundry test was also made by using "Persil" 25 and 50 times in washing pieces of cloth and observing the disintegration of the fibers. A diminution of only 7 to 14% in the integrity of the fibers was noted in 50 washings.

E. SCHERUBEL

The ash of the hull of the almond as an industrial product (DE DOMINICIS) 18.

FISCHER, MARTIN H.: Seifen und Eiweissstoffe. Ihre kolloidchem. Bedeutung. Dresden und Leipzig: Th. Steinkopff. 188 pp.

Detergent. D. E. HAKES and A. LAPEROU. U. S. 1,461,351, July 10. A mixt. adapted for cleaning the hands is formed of olive oil 1 oz., H<sub>2</sub>O 1 qt., extractive matter of 2 oz. soap bark, "washing powder" 6 oz., glycerol 1 oz., turpentine 1/4 oz., aqua NH<sub>4</sub> 1/4 oz., NaHCO<sub>3</sub> 2 oz. and wood flour 1.5 qts., all mixed and boiled to a pasty consistency.

Recovering soap from calcium carbonate sludge. P. KREBITZ. U. S. 1,459,773, June 26. CaCO<sub>3</sub> sludge such as is obtained in sol. soap manuf. from lime soaps is treated with a sufficient amt. of resin soap that the entire soap content of the sludge will comprise at least 20% of saponified resin and permit sepn. of a clear soap soln.

Recovering volatile solvents. SOC. GÉNÉRALE D'ÉVAPORATION PROCÉDÉS PRACHÉ ET BOUILLON. Brit. 190,174, Dec. 11, 1922. In extg. fatty oils from seeds, etc., by means of solvents such as CS<sub>2</sub>, CCl<sub>4</sub>, benzine, etc., the mixt. of oil and solvent is sepd. by distn. in the presence of H<sub>2</sub>O. The mixts. of oil and H<sub>2</sub>O obtained as residue and of solvent and H<sub>2</sub>O obtained as distillate are sepd. by decantation or centrifugal action. The distn. may be carried out at atm. or reduced pressure, and in a multiple-effect app. The H<sub>2</sub>O and the mixt. of oil and solvent in the still are kept constantly stirred.

## 28—SUGAR, STARCH AND GUMS

F. W. ZERBAN

Report of the Committee on Mechanical Progress of the American Sugar Cane League of the U. S. A. *Louisiana Planter* 71, 31-32(1923).—Improvements made and contemplated during the year 1922 in the manuf. of sugar are reviewed.

C. H. CHRISTMAN

Statistics of the distribution and yield of cane varieties in the season of 1922. J. VAN HARREVELD. *Arch. Suikerind.* 31, Mededeel. Proefstation Java-Suikerind. 163-241(1923); cf. *C. A.* 17, 1728, 2516.—Complete data are given in the form of tables for 174 out of 182 factories. Variety EK 28 is still first in point of area planted (39.25%; sugar yield 144 pikols per bouw). DI 52 (18.75%; 144 pikols) has taken second place instead of 247 B, which now occupies only 17% (116 pikols). EK 2 is fourth with 6.5% (134 pikols), and 100 POJ is becoming unimportant (4%; 126 pikols). F. W. ZERBAN

Hawaiian factory results for the 1921 season. E. T. WESTLY. *Sugar News* 3, 97-100(1922).—The data of 40 Hawaiian factories representing 99.8% of the Hawaiian crop indicates higher fiber and lower purity in the first expressed juice. The extn. has increased materially, nine mills having exceeded 98%. A record low polarization in bagasse, 1.5%, was obtained by using 39.3% maceration water and a small tonnage of cane per hr. This high extn. of sucrose has lowered the purity of the sirup. 1.66% sucrose was lost at the filter presses. The gravity purity of the final molasses was 38.53. The sugar produced polarized 96.75. Less sucrose is recovered under higher extn. than formerly when the extn. was not so thorough.

C. H. CHRISTMAN

"Direct consumption" sugars. GEOFFREY FAIRRIE. *Facts about Sugar* 17, 64(1923).—"Direct Consumption" sugars, by which the British mean sugar made from juice strained and clarified only a little more elaborately than for raw sugar, have been unjustifiably recommended by others but there is really little to choose between them and raw sugars. Chem. and bacteriological analyses are appended. T. S. H.

Fruit sugar. KARL MICKSCH. *Z. ges. Kohlensäure-Ind.* 28, 263-4; *Chem. Zentr.* 1922, IV, 592.—Together with a description of other types of sugar, the advantages and uses of fruit sugar recently manufd. on a com. scale from chicory (cf. *C. A.* 15, 1634) are explained.

C. C. DAVIS

Cost of steam in cane sugar manufacturing. R. WEIL. *Louisiana Planter* 70,

567-8(1923).—A critical study was made of the heat requirements of each process in the production of cane sugar. From these data it is seen that with proper combustion of bagasse there is more heat available than is required. Supplementary fuel should not be necessary if the factory is working at high efficiency. C. H. CHRISTMAN

**The purification of the juice with magnesia and lime.** G. BRÜHNS. *Z. Zuckerind. czechoslovak. Rep.* 46, 613-21; *Chem. Zentr.* 1922, IV, 1014.—A description of expts. carried out in 1890 on a large scale in Tapien and Wendessen by the Degener method of MgO sepn. These expts., though in no way discouraging, were not practicable because CaO gave equally good and cheap results. Only by the use of dolomite by Andriik and Kohn (*C. A.* 16, 3553; 17, 1346) could the MgO sepn. become practicable. C. C. DAVIS

**A review of the literature on decolorizing carbons.** J. F. BREWSTER. *Louisiana Planter* 70, 471-3(1923).—This very comprehensive review includes the methods of manuf. of decolorizing carbons, the employment of the carbons, their mode of action and evaluation and the regeneration of spent carbons. C. H. CHRISTMAN

**Adsorption of color from sugar solutions by chars.** M. T. SANDERS. *Ind. Eng. Chem.* 15, 784-5(1923).—Decolorization of sugar products by carbons follows the Freundlich adsorption equation. A study of the actual curves shows that less C is required in a counter-current system of application than when the C is used in one stage. The logarithmic curves for different carbons generally cross each other, which means that a certain % decolorization requires less of carbon A than of carbon B, while for another % decolorization the reverse is true; at the intersection of the curves both carbons are equally efficient. The decolorizing power of a C can therefore not be detd. by finding the decolorization effected by just one equal wt. of the two, nor by finding out how much more of one C it will take than of the other to bring about equal decolorization. Either method fixes only one point on the curve, and the only proper way is to find the consts. of the equation by detg. several points on the curve. This method does away with the necessity of having a "standard" C, and requires only the use of a standard sugar product. In practice, other factors besides decolorizing power must be taken into consideration. F. W. ZERBAN

**Calculations for decolorizing carbon.** M. T. SANDERS. *Ind. Eng. Chem.* 15, 785-6(1923); cf. *C. A.* 17, 1868 and preceding abstr.—An easy method to find the 2 consts. in the adsorption equation is to use double logarithmic paper 10 in. square and to plot the concn. in % of the initial concn., against the wt. of the C used. The consts. can then be read off directly without any calcn. However, this curve does not show directly how much C is required for a certain % decolorization. For solving this latter problem a monographic chart is presented, which is based on a slight modification of the Freundlich equation. This system permits direct application of lab. data in the plant. F. W. ZERBAN

**Clarification in cane sugar manufacture from the superintendent's viewpoint.** J. C. ETHERIDGE. *Louisiana Planter* 70, 408-9(1923).—Quality and quantity production in the sugar mill are governed at the mills, clarifiers and pans. The clarifiers det. the quality of the sugar. The quantity of molasses formed is detd. at this stage and this affects yields more than any other factor. Gums, salts, suspended matter and decomposed glucose increase the difficulties of obtaining a clear juice. Improperly clarified juice lowers the rate of evapn., increases the time required for drying and affects adversely the quality of the sugar. A need for more definite knowledge of clarification is expressed. C. H. CHRISTMAN

**Mechanical clarification by filtration.** A. S. ELSENBAST. *Sugar* 25, 381-2(1923); cf. *C. A.* 17, 2793.—Three systems of clarification in a 1500-ton house were tried: a heavy lime-sulfur treatment with 0.6 kg. Filter-Cel per ton of cane, used to precoat the presses; a light lime-sulfur treatment with 1.5 kg. Filter-Cel to aid filtration; and a filtration with 2.5 kg. Filter-Cel per ton of cane with no lime-sulfur treatment. All juices obtained were sparkling and a light lime-sulfur treatment was adopted. Dorr clarifiers were used; the clear juice was sent to the evaporators and the evaporated juice treated with Filter-Cel. Whiter sugar and lighter colored molasses resulted from this treatment. C. H. CHRISTMAN

**Conversion of muscavados into centrifugal sugars.** E. T. WESTLY. *Sugar News* 3, 411-3(1922).—Muscavados are usually over-limed and over-heated, running high in moisture. Previous treatment has consisted in melting, clarifying with lime and filter-pressing. Sugars produced in this way are darker than sugars made by melting at a low temp. and sending the sirup directly to the evaporators. In a test run the original crystals polarized 81.8 and a yield in 96° sugar of 53% was obtained. C. H. C.

**Precipitate forming in clarified cane juice after evaporation, and its prevention.**



M. BIRD. *Louisiana Planter* 69, 61(1922).—B. confirms the statement of Birkner (*C. A.* 16, 2425) that the silica content of the ppt. appearing in evapd. cane juice is about 34–7%. Bearing in mind the work of Müller (*C. A.* 15, 2561), the raw juice was heated to a comparatively high temp., viz., 120°, for a short time for the purpose of decomposing the colloidal organo-siliceous compds. which are believed to be present, and in this way a ppt. was obtained (weighing, after drying, about 0.4% of the weight of the cane), which could be strained off fairly well through fine wire gauze (about 100-mesh). Juice so treated required from  $\frac{1}{3}$  to  $\frac{1}{2}$  the amt. of lime which otherwise would be necessary to produce the best clarifying effect. Low-grade sugars made in this way could be crystd. and centrifuged much more easily than ordinarily, and a final molasses several degrees lower in purity could be obtained. J. S. C. I.

**Preparation of decolorizing carbons and the use of cane trash as a filtering medium.** C. E. COATES. *Facts about Sugar* 15, 257(1922).—On heating sawdust in crucibles in presence of a small quantity of air to a temp. sufficient to carbonize the material and expel most of the gases, viz., about 500°, a prepn. having a comparatively slight decolorizing power only was obtained. On the other hand, when this carbonized product was heated to a higher temp., viz., about 850°, its color-adsorbing activity rose considerably, it being observed that as the H present decreased the adsorbing power increased, pointing plainly to the strong inhibiting effect of the presence of hydrocarbons (cf. Chaney, *C. A.* 13, 3288). Cane trash left on the fields as a waste material after the crop has been reaped frequently contains 30–35% of ash, and by carbonizing it can be converted into an excellent filtering and decolorizing prepn. at a cost of about \$18 per ton. This trash char is said to be as good as infusorial earth in facilitating the filtration of cane juice, and has a decolorizing power exceeding that of many com. carbons, being able to abstract about 70% of the coloring matter originally present in the juice. J. S. C. I.

**Volume allowance for marc and for the combined marc and lead precipitate in the determination of sugar in cossettes by the Pellet method.** S. J. OSBORN. *Ind. Eng. Chem.* 15, 787–8(1923).—These vols. were found, for Nebraska and Colorado beets, by washing and drying the marc or combined ppt., and detg. sp. gr. in water or xylene. The latter solvent gave a lower sp. gr. The vol. of the marc in 26 g. beets averaged 0.6 cc., and that of the combined ppt. 0.9 cc., but these figures are considered to be below normal. There is no reason why allowance should not be made for the combined ppt., and the use of flasks contg. 201.0 cc. is proposed. F. W. ZERBAN

**The molasses furnace as a heat unit and potash extractor.** J. WYLLIE. *Sugar News* 4, 161–2(1923).—With molasses of 86 Brix as a fuel and with boiler-feed water at 180°F., one lb. of molasses evaps. 2 lbs. of water. The  $K_2O$  in ash averaged 25.66%; it was used as a fertilizer. With proper equipment, the green molasses could be used to develop much of the heat required for the factory. C. H. CHRISTMAN

**Cane supply in the centrals based on the crusher juice.** B. SERRANO. *Sugar News* 3, 156–9(1922).—To calc. the available sucrose in cane, use is made of the formula: Piculs of sugar per ton of cane = sucrose % juice + 2{[Purity — (166 — Extn.)]/100}. This is based on a gravity purity of 86.5 in molasses and a fiber of 11.5%. Extensive use of the formula has indicated its correctness. C. H. CHRISTMAN

**True purities in factory reports.** W. SNODGRASS. *Sugar* 25, 296(1923).—Calcs. of apparent purities may suffice for routine work. True purities should be the basis of all reports for a campaign. The losses shown will not be minimized by this system, but the occurrence of the loss will be made known. C. H. CHRISTMAN

**Sucrose determination in waste molasses.** H. A. COOK. *Sugar* 25, 291–2(1923).—In detg. sucrose in molasses the use of zinc dust after inversion is recommended. Sucrose averaged 0.09% higher when the zinc was added after making up to vol. This is within the range of error on a product like molasses. A max. difference of 0.23 in the gravity purity was found. To revert the action of Pb subacetate upon the rotatory power of fructose, 4 cc. of a satd. soln. of  $Al_2(SO_4)_3$  per 100 cc. is necessary. More does not influence results. Temp. and acid concn. in the inversion of sucrose must be carefully confined to the standard Herzfeld method or a recognized modification. C. H. C.

**The determination of the relative quantities of beet chips, extracted chips and pressed chips.** K. E. SKÄRBLÖM. *Zentr. Zuckerind.* 30, 906–8; *Chem. Zentr.* 1922, IV, 267.—Calcs. are given to show the distribution of losses of sugar at different points in the industrial process. C. C. DAVIS

**The "Halpa" patented apparatus for removing exhausted chips from diffusers.** F. HOUB. *Z. Zuckerind. czechoslov. Rep.* 47, 353–4(1923).—An angle valve is attached to the outside of the diffuser near the bottom and connected to the wash water line. Inside the diffuser is attached a metal housing, which contains a rotatable angle nozzle.

so placed that it directs a jet of water horizontally across the bottom screen. The spindle of the angle valve carries a sprocket over which a chain runs for rotating the nozzle so that the screen is completely washed. A 50-hl. cell is emptied in less than a minute from the time of unfastening the door.

W. L. BADGER

A study of the comparative rate of moisture absorption of plantation white, and refined granulated sugars. W. L. OWEN. *Louisiana Planter* 70, 469-71 (1923); cf. C. A. 17, 1164.—Samples of plantation white sugar were compared with a very high-grade refined sugar to study the rate of moisture absorption. Samples were exposed in desiccators over water at 30°, giving 100% humidity and over  $H_2SO_4$  at 25° Brix. Samples high in polarization gave low moisture absorption, one-third of the plantation sugars absorbing less moisture than the standard granulated. The max. rate of absorption occurred in the first 24 hrs., and the least rate in the third 24-hr. period of a 96-hr. test. The greatest rate of absorption was in sugars which were not of uniform grain.

C. H. CHRISTMAN

Sugar-cane molasses. FRIEDRICH WENDEL. *Brennereiztg.* 39, 206; *Chem. Zentr.* 1922, IV, 1058.—The sugar content of cane molasses is higher than that of beet molasses; it varies from 52 to 58% and consists of a mixt. of cane and invert sugar. The manuf. of EtOH is not essentially different from the regular process and offers no particular difficulties, but the addn. of a large amt. of N in the form of yeast ext. or  $NH_4$  salt is recommended. The cultivation of yeast on the other hand offers many difficulties; these have been overcome by the following process. The acid sugar cane molasses is dild. to 15-8° Balling, is mixed with superphosphate (2-3% by wt.) or an aq. lye, and while boiling made alk. with NaOH or a  $Ca(OH)_2$  suspension and the flocculent ppt. is filtered off. The clear filtrate on addn. of mineral acids gives no further ppt. at its b. p., contains only 0.1% assimilable N (calcd. on the dry wt.) and gives normal yields of yeast of normal quality.

C. C. DAVIS

The washing of the saturation gas. ASKAN MÜLLER. *Z. Zuckerind. czechoslovak. Rep.* 46, 268-70; *Chem. Zentr.* 1922, IV, 56.—A washer is described and illustrated which need not be driven by sep. mech. means, but is rotated by the pressure of the gas pump.

C. C. DAVIS

Waste molasses for fermentation purposes (Cook) 16.

WOHRZYK, OSKAR: Betriebskontrolle der Zuckerfabrikation. I. Magdeburg: S. Rathke. 331 pp.

Sugar. PLAUSON'S (Parent Co.), LTD. (H. PLAUSON). *Brit.* 190,314, Oct. 28, 1921. Beet is disintegrated so as to rupture the cells, either by heat and pressure or by treatment in a "colloid mill" such as that described in 155,836; it is then filtered in a pressure-filter that will sep. suspended colloids, such as that described in 155,834 and 181,013 (C. A. 16, 3519). The pores of the filter element may be reduced in size by causing cement to set in them, and the cement may be impregnated with rubber soln. and dried. The disintegrated beet may be treated before filtration with  $CaO$  and  $CO_2$  or with decolorizing C and fuller's earth, or by both methods. The filtered soln. may be again treated with these reagents and filtered.

Apparatus for manufacturing dextrin. TADAO KIMURA. *Japan.* 41,518, Jan. 25, 1922. The app. is a horizontal elliptical tube having an agitator, acid sprayer, cooling and heating tube, and a conveyer. Dried starch is agitated in the tube, mixed with an acid and heated for production of dextrin.

Apparatus for purifying starch. TADAO KIMURA. *Japan.* 41,520, Jan. 25, 1922. Addition to 39,463 (C. A. 16, 3010). The app. is a V-shaped horizontal vessel having crushing rolls, spiral conveyer at the bottom and belt for collecting impurities. Crushed corn or kaoliang is introduced into the vessel, filled with  $H_2O$ , and starch is sepd. completely from endosperm, etc., by the difference of density.

Purifying gums. L. EYNON and J. H. LANE. *Brit.* 190,032, Jan. 9, 1922. Crude gums are sepd. from woody matter or other insol. impurities and are partially decolorized by dissolving them in  $H_2O$  in the presence of an alk. earth such as  $CaO$ ,  $SrO$ , or baryta, decanting or filtering the soln., and pptg. the gum by  $H_2SO_4$ ,  $H_2SO_3$ ,  $HCl$  or other acid. Examples are given.

## 29—LEATHER AND GLUE

ALLEN ROGERS

**The science of soaking.** G. D. McLAUGHLIN AND E. R. THEIS. *J. Am. Leather Chem. Assoc.* **18**, 324-58(1923).—The greater the extent to which salted steer hide was allowed to dry prior to soaking, the less it swelled during soaking and subsequent liming. The sol. proteins are dissolved out more readily when the hides are fleshed before soaking. The compn. of the soak water materially affects the amts. of total and coagulable nitrogenous matters dissolved. Measurements of degree of swelling of hide in acid and alk. solns. are given, but the systems are much too complex to permit drawing quant. conclusions. Strongly alk. solns. dissolve more nitrogenous matters than acid solns. of equal normality. The less the proportion of water to hide used in soaking the greater the loss of nitrogenous matter. J. A. WILSON

**Use of formic acid in soaking dry hides.** G. GRASSER. *Häute Lederber* **13** (1922); *Z. Leder Gerberet Chem.* **2**, 109(1922); *J. Am. Leather Chem. Assoc.* **18**, 393.—From 0.6 to 0.8 kg. of 80% formic acid to 100 kg. of hide in 1,000 l. of water has been found sufficient for soaking dry hides. Formic acid has the additional advantage over other org. acids that it sterilizes the hides. Although hide so soaked loses its hair more slowly, this can be overcome by sharpening the limes with  $\text{Na}_2\text{S}$ . Hides soaked in water contg. formic acid are firmer, shoulder and belly remain thicker, and the grain layer is heavier in proportion to total hide weight. H. G.

**Some biochemical notes on animal skin.** G. D. McLAUGHLIN AND E. R. THEIS. *J. Am. Leather Chem. Assoc.* **18**, 307-24(1923).—Frigorifico hides, which are washed in the fresh condition and then soaked in satd.  $\text{NaCl}$  soln. prior to salting, putrefy much less readily under fixed conditions than native hides which have been salted without previous washing and brining. The progress of putrefaction was followed by measuring the amt. of  $\text{NH}_3$  produced. During soaking, putrefaction is favored by the presence of blood and by heating to  $37^\circ$ , but inhibited by strong  $\text{NaCl}$  soln. The hide gives up more nitrogenous matter to physiol. salt soln. than to pure water. J. A. WILSON

**The artificial drying of leather.** M. HIRSCH. *Ind. Technik* **3**, 125-7; *Chem. Zentr.* **1922**, IV, 602-3.—To prevent local overheating and to obtain uniform and economical drying, the heating of the air and the proportion of circulating air returned through the system to the fresh air drawn in are varied as drying progresses. C. C. DAVIS

**Spueing of leather.** G. GRASSER. *Häute Lederber* **7** (1922); *Z. Leder Gerberet Chem.* **2-3**, 108(1922); *J. Am. Leather Chem. Assoc.* **18**, 393-4.—Spue can generally be traced to the presence of free fatty acids, which may have been present in the hide or in the oils used for fat-liquoring. Cholesterol, a natural constituent of wool grease, is also responsible for some spueing. Neutral neatsfoot oil, sperm oil and Turkey red oil are recommended for use in fat-liquors. Oiling the surface of dark colored chromic leather with mineral oil unaffected by low temps. prevents spueing. H. G.

**Salting of hide.** G. GRASSER. *Häute Lederber* **11** (1922); *Z. Leder Gerberet Chem.* **2**, 108(1922); *J. Am. Leather Chem. Assoc.* **18**, 392-3.—Among the errors of hide conservation those resulting from use of impure salt predominate. To avoid damage it is necessary to employ pure salt, to apply it correctly and in sufficient quantity. Otherwise, salt stains and decompn. result. As a means of prevention of salt stains, denaturing the salt with 4% of soda has given the best results. H. G.

**Note on babul (*Cassia auriculata*) seeds as a deliming agent.** M. J. KHAN. *J. Soc. Leather Trades Chem.* **7**, 255-6(1923).—A fermenting infusion of babul seeds is a good substitute for wheat bran as a deliming agent; no harm is done to hides left in such a liquor longer than is necessary to delime them. J. A. WILSON

**Chrome tanning.** XVI. Donald Burton. *J. Am. Leather Chem. Assoc.* **18**, 358-71(1923); cf. C. A. **17**, 2201.—A general review and discussion of some phases of chrome tanning, with special emphasis laid upon the effect of acetates.  $\text{AcONa}$  in sufficient quantity will prevent the pptn. of chrome liquor by alkali, the effect being subject to a time factor. No improvement in chrome tanning seemed to result from the addn. of acetic acid. XVII. D. BURTON, R. P. WOOD AND A. GLOVER. *Ibid* 372-89.—A study was made of the relation between tanning properties of a chrome liquor and the pptn. figure; i. e., the no. of cc. of 0.1 N  $\text{NaOH}$  required to start pptn. of 10 cc. of the chrome liquor. With liquors made in different ways, the rate of tanning increased as the pptn. figure decreased. The tanning properties of chrome liquors are largely detd. by the Cr concn. and the pptn. figure. J. A. WILSON

**Loss of tannins during the drying of myrobalans.** A. N. SRIVASTAVA. *J. Soc.*

*Chem. Ind.* 42, 272T(1923).—Fungi rapidly destroy the tannin of wet myrobalans; in one test the tannin content was reduced in 4 days from 51 to 28%. This action may be prevented by rapid drying or by the use of toluene, phenol or  $\text{SO}_2$ . It is recommended that the fruit be chopped and passed at once through a continuous rotary drier supplied with hot flue gases contg. a small amt. of  $\text{SO}_2$ . J. A. WILSON

**Note on the absorption of solutions of tanning materials in the ultra-violet.** M. C. LAMB AND V. C. W. BROWN. *J. Soc. Leather Trades Chem.* 7, 256-62(1923).—The procedure described by De la Bruère (cf. *C. A.* 17, 1734) was applied to exts. of oak wood, chestnut wood, myrobalans, gambier, quebracho, mimosa, and sumac and the results seemed to indicate that measurement of absorption in the ultra-violet of a mixt. of tanning materials would give no clue as to the kind or amt. of tanning material present, except possibly in simple mixts., where the components were known and had previously been studied. J. A. WILSON

**The high-temperature organism fermenting tan bark.** R. GREIG-SMITH. *Proc. Linnæan Soc. N. S. Wales* 48, 1-16(1923); cf. *C. A.* 14, 3166; 15, 3127. —It has been shown that "tempered" tan bark was attacked by a thermophilic bacterium giving off  $\text{CO}_2$ . An aq. ext. of tan bark, together with the bark itself, was inoculated with bacteria and molds and the  $\text{CO}_2$  evolved was measured. Molds attack the cellulose, forming products which are fermented by the high-temp. bacterium. The characteristic fermentable substance is believed to be humic acid. F. W. T.

**The gelatin-tannin reaction.** A. W. THOMAS AND ALEXANDER FRIEDEN. *Ind. Eng. Chem.* 15, 839-41(1923).—Gelatin is completely pptd. by gallotannic acid when the ratio of tannin to gelatin is not less than 2:1, and the gelatin-tannin ppt. is not sol. in excess of tannin. Each kind of vegetable tanning material has its own optimum H-ion concn. for this pptn. and, if the soln. is not adjusted approx. to this reaction, the ppt. may fail to form. All optimum  $p_H$  values found lay in the range 3.5 to 4.5. The range for optimum pptn. is widened by the addn. of neutral salt, but salt does not increase the sensitivity at the optimum  $p_H$  value, at which it is possible to detect 1 part of tannin in from 100,000 to 200,000 parts of water, depending upon the source of the tannin. In testing solns. for tannin, aging of the gelatin soln. has no effect upon the sensitivity so long as bacterial action is prevented. J. A. WILSON

The practical application of sulfurized oil (PUMMER) 27. Water in tannery practice (HARVEY) 14.

BAUER, K. H.: *Monographien aus dem Gebiete der Fett-Chemie. Part II.* KISSLING-BREMEN, R.: *Leim und Gelatine.* Stuttgart: Wissenschaftliche Verlagsgesellschaft M.b.H. 214 pp.

**Leather.** F. G. EDWARDS. *Brit.* 189,942, Oct. 20, 1921. In the manuf. of patent leather, a no. of coats of varnish, composed of a mixt. of cellulose acetate, acetone,  $\text{C}_2\text{H}_5\text{Cl}$ , MeOH, triacetin, linseed oil, and benzene, are applied to the leather, and after the hardening of the varnish, the product is washed with dil. alc., squeezed to remove the excess, and finally matured. To prep. the varnish, cellulose acetate, acetone,  $\text{C}_2\text{H}_5\text{Cl}$  and MeOH in stated proportions are agitated in a vessel adapted to prevent evapn. until a clear soln. is obtained, and to this soln. triacetin and, after further agitation, linseed oil and benzene are added, the mixt. being again agitated and finally filtered. When applied to the grain side of a skin, the mixt. may be rubbed in with a pad of cotton fabric, but when applied to the flesh side, a brush or spray is preferably used. After hardening and washing in alc., the leather is placed on a glass sheet and rolled out, and, on removal, is hung up to mature. Coloring matter, preferably sol. in MeOH, may be added to the coating mixt. with the linseed oil and benzene. Glacé kid may be prepd. by this process, the finishing operation being omitted.

**Imitation leather.** SHÔSAKU NEGISHI and YASUSHI KUSUDA. *Japan.* 41,538, Jan. 27, 1922. A paper manufd. from fiber of the banana tree and a suitable sizing material is coated with a layer of bamboo fiber and a suitable sizing material. After drying it is painted with a dil. glycerol soln. and a celluloid soln. By the contraction of the banana fiber the other surface is slightly shrunken.

**Enamelled leather, fabrics, etc.** A. DINSLEY AND A. O. PULMAN. *Brit.* 190,781, Sept. 23, 1921. The material is impregnated with a soln. which is homogeneously distributed throughout the substance of the material and which produces a flexible film on both surfaces, the film on the supper surface serving as a support for the enamel coating. The film on the lower surface may have impressed or otherwise produced

therein a pattern to increase the strength of the material and facilitate the manuf. of articles therefrom. The impregnating medium may be the substances generally employed for coating one side of the material preparatory to enamelling, and may be applied by hand or machine or in a vacuum plant. Before impregnating, the material may be exposed to the action of X-rays, ultra-violet rays or the rays from a Hg-vapor lamp to impart uniformity and a restoration of the structure partly destroyed by tanning and like processes.

**Synthetic tanning composition.** S. KOHN. U. S. 1,460,422, July 3. A carbohydrate such as dextrose is dissolved in  $H_2SO_4$  and the soln. is treated with PhOH in smaller proportion than that required to combine with the  $H_2SO_4$  and with the hexose in soln. to form a phenolsulfonylhexose. Sulfonating conditions are maintained to produce penta-*p*-phenolsulfonylhexose, which is used for tanning.

**Glue for veneer.** P. SCHRÖT. U. S. 1,460,341, June 26. Five kg. leather glue which has been soaked for 14 hrs. in  $H_2O$  is mixed with lenzin 10 kg., ocher 5 g. and  $H_2O$  3 l.

### 30—RUBBER AND ALLIED SUBSTANCES

JOHN B. TUTTLE

**Isoprene and rubber. III. The addition of halogen acids to isoprene.** H. STAUDINGER, W. KRIS AND W. SCHULT. *Helvetica Chim. Acta* 5, 743-56 (1922); cf. C. A. 7, 3503.—Addn. of halogen acids to isoprene (I) takes place in the 1,4-positions, as in the case of rubber formation.  $Me_2C:CHCH_2Br$  (II),  $b_{12}$  26-33°, is obtained in 74% yield from 100 g. I and 122 g. HBr in 30% AcOH after 2 days at 0°. Its constitution was established by converting it into  $Me_2C:CHCH_2CH(CO_2Et)_2$ ,  $b_{11}$  127°, sapon. to dimethylallylmaleic acid, m. 95.5-6° (87% yield), transformation to dimethylallylacetic acid ( $\delta$ -methyl- $\Delta^1,5$ -hexenic acid),  $b_{10}$  103-5°, and oxidation to  $Me_2C(OH)COCH_2CH_2CO_2H$  (Ann. 314, 489). *Guaiacol dimethylallyl ether*,  $MeOC_6H_4OCH_2CH:CM_2$ ,  $b_{13}$  140°, in 52% yield from  $MeOC_6H_4ONa$  and II; heating at 220° for 2.5 hrs. gave *p*-dimethylallylguaiacol,  $b_{12}$  m. 148-9° (40% yield); this with  $MeSO_4$  yields dimethylallylveratrole,  $b_{10}$  140°, which, on oxidation, yields 3,4-( $MeO$ ) $_2$  $C_6H_3CO_2H$ . Mg with II forms tetramethyldiallyl,  $b_{11}$  45-50°, the bromide of which,  $C_{10}H_{18}Br$ , m. 124-7°; a liquid bromide was also formed. Oxidation gave a mixt. of succinic and dimethylsuccinic acids.  $PhMgBr$  and II give dimethylallylbenzene (isopentenylbenzene),  $b_{12}$  90°. Mg and  $CO_2$  with II give  $Me_2C:CHCH_2CO_2H$ . IV. Isoprene dibromide. H. STAUDINGER, O. MUNTWYLER AND O. KUPFER. *Ibid* 756-67.—Isoprene dibromide (III) has the constitution  $CH_2BrCMe:CHCH_2Br$ , since on oxidation it yields  $BrCH_2CO_2H$ . Oxidation in AcMe with  $KMnO_4$  gives  $BrCH_2CMe(OH)CH(OH)CH_2Br$ , m. 127°, which, on further oxidation, also yields  $BrCH_2CO_2H$ . In the hope of further establishing the constitution of III, it was condensed with  $Na_2C(CO_2Et)_2$ , giving di-Et 3-methyl- $\Delta^{1,4}$ -pentaadiene-1,1-dicarboxylate,  $b_{15}$  117-8° (yield, 14%). Reduction gave  $Me_2CHCH_2CH_2CH(CO_2Et)_2$ . Sapon. of the unreduced acid and splitting off of  $CO_2$  gave an acid,  $C_7H_{10}O_2$ ,  $b_{11}$  118-20°. If the reaction product with  $CH_2(CO_2Et)_2$  is not distd. but sapond. at once, the lactone of  $\delta$ -methyl- $\gamma$ -hydroxypentene- $\alpha$ -carboxylic acid,  $b_{12}$  105-10°, results. It adds Br and H and on oxidation yields  $(HO_2CCH_2)_2$ . A 2nd product is a lactone acid,  $C_8H_{10}O_4$ , m. 119-22°, the mono-Et ester of which m. 85-6°. A 3rd product is a dicarboxylic acid,  $C_9H_{10}O_6$ , m. 80°. Isoprene tetrabromide,  $b_{12}$  153-5°, with the calcd. amt. of MeONa yields a dibromoisoprene,  $b_{12}$  78-83°; on heating it decomps. quickly but does not yield the characteristic rubber-like product. III, in the same way, yields a monobromoisoprene, b. 120°, which does not polymerize in the cold, but decomps. when heated. V. Reduction of rubber and its constitution. H. STAUDINGER AND J. FRITSCH. *Ibid* 785-806.—Rubber was purified by extn. with a mixt. of  $CHCl_3$ -AcMe (ratios of 20-80 to 40-60%) for 8-14 days, thus removing 4-5% resins. 340 g. were distd. in 2 portions at 0.1-0.3 mm., giving 216 g. distillate (63.5%) and 123 g. resin (36.5%). There were isolated 3.1% isoprene; 8.8% dipentene; 4.4% of the compd.  $C_{15}H_{24}$ ,  $b_{10-16}$  88-91°,  $d_4^{20}$  0.8895,  $n_D^{20}$  1.4980; about 4% of the compd.  $C_{20}H_{32}$ ,  $b_{10-12}$  118-22°,  $d_4^{20}$  0.9046,  $n_D^{20}$  1.5065;  $C_{24}H_{40}$ ,  $b_{10-14}$  142-8°,  $d_4^{20}$  0.9161,  $n_D^{20}$  1.5119. Reduction of rubber to hydorrubber,  $C_{16}H_{26}$ , was carried out by mixing the rubber with Pt (by adding the Pt to a  $C_4H_6$  soln. of the rubber and pptg. with EtOH) and then heating to 270° in 93 atm. H for 10 hrs. The product is a completely colorless, transparent, sticky mass but completely lacking the elastic properties of the original rubber. It is sol. in  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$  but insol. in EtOH and AcMe. These solns. are colloidal and do not decolorize Br, though on long

standing substitution occurs. Upon decompn. in high vacuum, a higher temp. is required but, unlike rubber, only a very small residue remains in the flask, 80 g. product giving 74 g. distillate. Of this 10.1% boiled at 55–75° (4 mm.); 6.1%, 75–150°; 16.9%, 150–220°; 17.6%, 220–270°; 22.3%, 270–315°; 24.3%, 315–320°. The fractions vary from  $C_{16}H_{100}$  to  $C_8H_{16}$ , are unsatd. (1 double bond) and add 1 atom Br. These products indicate a very large mol. wt. for rubber. Hydorrubber is recovered unchanged from  $S_2Cl_2$  in  $C_6H_6$  (no vulcanizing effect). The same hydorrubber was obtained by hydrogenation of latex-rubber.

C. J. WESS

The occurrence of rubber and latex vessels on the leaves of *Hevea brasiliensis*. W. BOBILIOFF. *Arch. Rubbercultuur* 7, 205–15 (1923).—There is no connection whatever between the amt. of rubber in the leaves and the productivity of the trees. On the basis of the appearance of latex vessels in such a relation to the assimilating cells as easily to take up assimilation products, the idea is advanced that they fulfil in the plant the function of conducting vessels for food material.

R. BEUTNER

The influence of seasonal variations in latex and rubber. O. DE VRIES AND W. SPOON. *Arch. Rubbercultuur* 7, 217–40 (1923).—Over a period of more than a year rubber was regularly prepd.—according to strictly standardized methods—from three groups of trees. The figures observed show that seasonal variations such as wintering, flowering or seedtime cause no appreciable variations of the vulcanizing properties, tensile strength or slope of the rubber.

R. BEUTNER

Accelerated aging of vulcanized rubber. B. MARZETTI. *Giorn. chim. ind. applicata* 5, 122–4 (1923).—Accelerated aging of vulcanized rubber is a fact of a chem. order, being due to successive vulcanization produced by the O of the air. The various tendencies of different qualities of vulcanized rubber to aging depend upon the different velocities with which the O is absorbed. M. recommends for the test a thermostat of large capacity heated with alc. vapor in all its walls, including even the top. The air should enter at the bottom (through tubes which are also immersed in the alc. vapor for sufficient distance to guarantee the air having acquired the proper temp. before entering the thermostat), and come out at the top. The current of air that is automatically set up by the heating is sufficient for the test. The air supplied should first be filtered through soda-lime to dry it and remove any acidity. A thermometer should assure that the temp. remains very close to 77°. The life of the sample of rubber is shortened with increase of the degree of vulcanization it has received. While O is being taken up by the rubber during aging, there is apparently no gas of any kind set free. The velocity of aging, i. e., the velocity of absorption of O, increases with the amt. of previous vulcanization. A sample of rubber (100 parts smoked sheet, 8 parts S) vulcanized at 143° for 70 min. and held in the thermostat at 77° for 168 hrs. to practically complete degeneration absorbed 10.4 mg. O per g. rubber, with a velocity of absorption of O (O absorbed/time in thermostat) of 0.62. The same rubber previously vulcanized for 206 min. at 143° required 39 hrs. in the thermostat to reach the same degree of degeneration as the first sample, with an absorption of 3.0 mg. O per g. rubber and a velocity of absorption of O autg. to 2.45. To compare different compns. of rubber as to their aging qualities, it is necessary, therefore, to know their resp. degrees of vulcanization. Technically one may compare different rubber compns. which have the same values for the parameter-load (load in g. per sq. mm. of original cross section to give an elongation of 3). Org. accelerators increase the life of rubber because they bring about a slower absorption of O.

ROBERT S. POSMONTIER

The resilient energy and abrasion resistance of vulcanized rubber. H. A. HOLZ. *Ind. Eng. Chem.* 15, 755 (1923).—Polemical. Exception is taken to the statement that resistance to abrasion is a function of hardness (cf. C. A. 17, 2204), and it is further maintained that "hardness," "toughness" and "resilient energy" in their true significance have never been measured for rubber.

C. C. DAVIS

The resilient energy and abrasion resistance of vulcanized rubber. H. W. GREIDER. *Ind. Eng. Chem.* 15, 755–6 (1923).—A reply (cf. preceding abstr.). "Hardness" as measured by a durometer is practically identical with rigidity or stiffness as represented by the stress required to obtain a 300% elongation, and is a valuable index of the resistance to abrasion (cf. C. A. 17, 1410).

C. C. DAVIS

Aggregation and disaggregation. Hydrogenation of rubber (HARRIES) 2. Electro-viscous effect in rubber sol (KRUYT, EGGINK) 2. Use of latex in waterproofing (HARD) 25.

Rubber. C. REID. *Brit.* 190,510, July 20, 1921. Rubber latex or a soln. of rubber is subjected to the action of gases, such as air,  $O_2$ ,  $SO_2$ ,  $H_2S$ , and  $SCl_2$ , by being

sprayed into the interior and towards the apex of a converging cone of the gas. The atomizers described in 161,805 and 188,870 may be used for carrying out the process. Latex may be dried by using hot or cold gas previously freed from moisture.

**Rubber-like substances.** H. PLATSON. Can. 232,641, July 10, 1923. A polymerizable hydrocarbon contg. the grouping  $\text{—C=C—C=C—}$  is treated with an acrolein-amino compd., e. g., 100 parts of liquid butadiene and 4–6 parts of acrolein methylamine are allowed to stand at atm. temp. and 300 atms. pressure from 1 to 2 weeks to produce a product resembling good natural rubber, which can be readily rolled and vulcanized. A small quantity of alkali or  $\text{NH}_3$  will further accelerate the polymerization. A greater amt. of the acrolein-amino compd. will give a leather-like and ebonite-like substance.

**Vulcanizing rubber.** S. M. CADWELL. Brit. 191,085, Feb. 15, 1902. Addn. to 177,493 (C. A. 16, 3233). A vulcanizing accelerator consists of a thiuram disulfide contg. substituted alkyl and aryl groups, such as diphenyldimethylthiuram disulfide, diethyldiphenylthiuram disulfide, diparamethylphenylenedimethylthiuram disulfide. Suitable proportions are 100 parts of rubber, 10 parts of  $\text{ZnO}$ , 3 parts of S and  $1/10$  part of dimethyldiphenylthiuram disulfide. This substance is prepd. by dissolving 480 parts of monomethylamine, 170 parts of  $\text{CS}_2$ , and 285 parts of I in alc., and allowing to stand until crystals are formed. The crystals are sepd., washed with alc. and air-dried. Cf. C. A. 17, 1560.

**Reclaiming vulcanized rubber.** W. B. PRATT. U. S. 1,461,675, July 10. Vulcanized rubber to be reclaimed is digested with 2–10% of a volatile solvent obtained by heating oil of turpentine with oxalic acid and freeing the product of acid.







